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OUTER CONTINENTAL SHELF OIL AND GAS INFORMATION PROGRAM

Outer Continental Shelf Oil and Gas Activities
in the Gulf of Alaska (including Lower Cook Inlet)
and their Onshore Impacts:
A Summary Report, September 1980

Prepared for the U.S. Department of the Interior, Geological Survey,
in cooperation with the Bureau of Land Management
and the Council on Environmental Quality

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COVER.--The **Ocean Ranger**, semisubmersible rig, which drilled in the Gulf of Alaska and Lower Cook Inlet April 1977 to April 1980 (photograph from Anchorage USGS files).

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A Summary Report, September 1980

by Joanne Barnes Jackson
and Richard T. Dorrier

Prepared for the U.S. Department of the Interior, Geological Survey,
in cooperation with the Bureau of Land Management
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under Contract No. EQ9AC006, by

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METRIC-ENGLISH CONVERSION

(The following table gives the factors used to convert metric units to English units.)

Multiply metric units	by	to obtain English units
meters	3.281	feet
kilometers	0.621	miles
hectares	2.471	acres

ABBREVIATIONS AND ACRONYMS

ANCSA	-	Alaska Native Claims Settlement Act of 1971.
APD	-	Application for Permit to Drill
ARCO	-	Atlantic Richfield Company
bbl	-	barrel(s)
BLM	-	Bureau of Land Management, U.S. Department of the Interior
bpd	-	barrels per day
CEIP	-	Coastal Energy Impact Program, administered by the Office of Coastal Zone Management of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce
cf/d	-	cubic feet per day
CFR	-	Code of Federal Regulations
COST	-	Continental Offshore Stratigraphic Test
CZM	-	Coastal Zone Management
DEIS	-	Draft Environmental Impact Statement
EA	-	Environmental Assessment
EIR	-	Environmental Impact Report
EIS	-	Environmental Impact Statement
FO	-	Field Office(s), BLM
FR	-	Federal Register
IPP	-	Intergovernmental Planning Program for OCS Oil and Gas Leasing, Transportation and Related Facilities, BLM
LNG	-	liquefied natural gas
NEPA	-	National Environmental Policy Act of 1969
OCS	-	Outer Continental Shelf (Federal jurisdiction)
OCSI	-	Office of Outer Continental Shelf Information, USGS
ODECO	-	Ocean Drilling Exploration Company
PNS	-	Proposed Notice of Sale
RTWG	-	Regional Technical Working Group, BLM
SID	-	Secretarial Issue Document, U.S. Department of the Interior
2974	-	Order from the Secretary of the Interior on Inter-Bureau Coordination in the OCS Minerals Program
USGS	-	U.S. Geological Survey, Department of the Interior
WO	-	Washington Office, BLM

Acknowledgments

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At Rogers, Golden & Halpern, Fritts Golden provided overall project direction. Sandy Dechert designed and edited the report and supervised its production. Mark Yankoski directed cartography and graphics production, and Deborah Gould, Margaret Judd, Sue McGuire, Valerie Smith, Pam Staubus, and Kim Tomlinson provided editorial, graphics, and technical support.

Abstract

The search for oil and gas on the Outer Continental Shelf (OCS) in the Gulf of Alaska subregion of the Alaska leasing region began in 1967, when geophysical surveys of the area were initiated. Two lease sales have been held in the subregion. Lease Sale 39, for the Northern Gulf of Alaska, was held on April 13, 1976, and resulted in the leasing of 76 tracts. Lease Sale CI, for Lower Cook Inlet, was held on October 27, 1977, and resulted in the leasing of 87 tracts. Exploratory drilling on the tracts leased in Sale 39 began in September 1976, and exploratory drilling on tracts leased in Sale CI began in July 1978.

Commercial amounts of hydrocarbons have not been found in any of the wells drilled in either sale area. Seventy-four of the leases issued in the Northern Gulf of Alaska have been relinquished. As of June 1980, exploratory drilling in both areas had ceased, and none was planned for the near future. The next lease sale in the Gulf of Alaska, Sale 55, is scheduled for October 1980. Lease Sale 60 (Lower Cook Inlet and Shelikof Strait) is scheduled for September 1981, and Lease Sale 61 (OCS off Kodiak Island) is scheduled for April 1983. Sale 60 will be coordinated with a State lease sale in adjacent State-owned waters.

The most recent estimates (June 1980) by the U.S. Geological Survey of risked, economically recoverable resources for the 2 tracts currently under lease in the Northern Gulf of Alaska are negligible. For the 87 tracts currently under lease in Lower Cook Inlet, the USGS has produced risked, economically recoverable resource estimates of 35 million barrels of oil and 26 billion cubic feet of gas. These resource estimates for the

leased tracts in both areas are short of commercially producible amounts.

Onshore impacts from OCS exploration have been minimal. Two communities--Yakutat and Seward--served as support bases for the Northern Gulf of Alaska. Kenai and Homer provided support for the exploratory drilling in Lower Cook Inlet.

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Introduction

The United States is currently engaged in an effort to develop the oil and gas resources of the Outer Continental Shelf (OCS). Offshore oil and gas activity must be supplied and supported from land, and the required onshore support activities required may have significant effects on the communities in which they occur. For example, oil and gas production might require expansion of existing transportation facilities and construction of new ones, and it might trigger an influx of workers and change employment patterns. These effects, in turn, could influence regional income, demand on public services, tax revenues, and air and water quality.

The need for planning to accommodate the onshore impacts of offshore oil and gas development has long been recognized. State and local governments need current information to make these plans. In response to needs expressed by State and local governments for current information about offshore resources and related onshore activity, Section 26 of the Outer Continental Shelf Lands Act Amendments of 1978 (43 U.S.C. 1352) created an Outer Continental Shelf Oil and Gas Information Program, which is now managed by the Office of Outer Continental Shelf Information (OCSI), U.S. Geological Survey, Conservation Division. Authorities and operating procedures are detailed in the Code of Federal Regulations (30 CFR 252), published in the Federal Register of August 7, 1979. Under this program, the Director of the U.S. Geological Survey (USGS), in conjunction with the Director of the Bureau of Land Management (BLM) (43 CFR 3300), has prepared indexes of information used by the Federal Government in its OCS decisionmaking process. The Atlantic, Gulf of Mexico, Pacific, and Alaska Indexes have already been made available to

In the Gulf of Alaska and Lower Cook Inlet, State jurisdiction extends 4.8 km (3 miles) seaward from the coastline. The OCS is under Federal jurisdiction and comprises the submerged lands of the Continental Shelf seaward of State boundaries.

the public. Revisions, which are made annually, are currently under way.

The Director of the USGS is also required to make available to affected States a Regional Summary Report of data and information designed to assist them in planning for the onshore impacts of potential OCS oil and gas development and production.

This report, **Outer Continental Shelf Oil and Gas Activities in the Gulf of Alaska (including Lower Cook Inlet) and their Onshore Impacts**, is the fourth in a series of Summary Reports. It was preceded by reports on the Mid-Atlantic, Pacific (Southern California), and South Atlantic. The Gulf of Mexico Summary Report is in press, and a Summary Report for the North Atlantic Region will be written in the spring of 1981. Summary Reports for other subregions of Alaska will be written when events warrant.

The State of Alaska comprises one leasing region of the U.S. Outer Continental Shelf. However, the Alaska OCS comprises 74 percent of the total area of U.S. offshore lands because of its 10,686-km (6,640-mi) coastline and the wide extent of the Continental Margin surrounding the State. The size of the Alaska OCS and the unique environmental conditions in Alaska make it practical to divide the leasing region. The USGS Conservation Division has therefore divided the State into three subregions for purposes of developing operating orders--the Gulf of Alaska (including

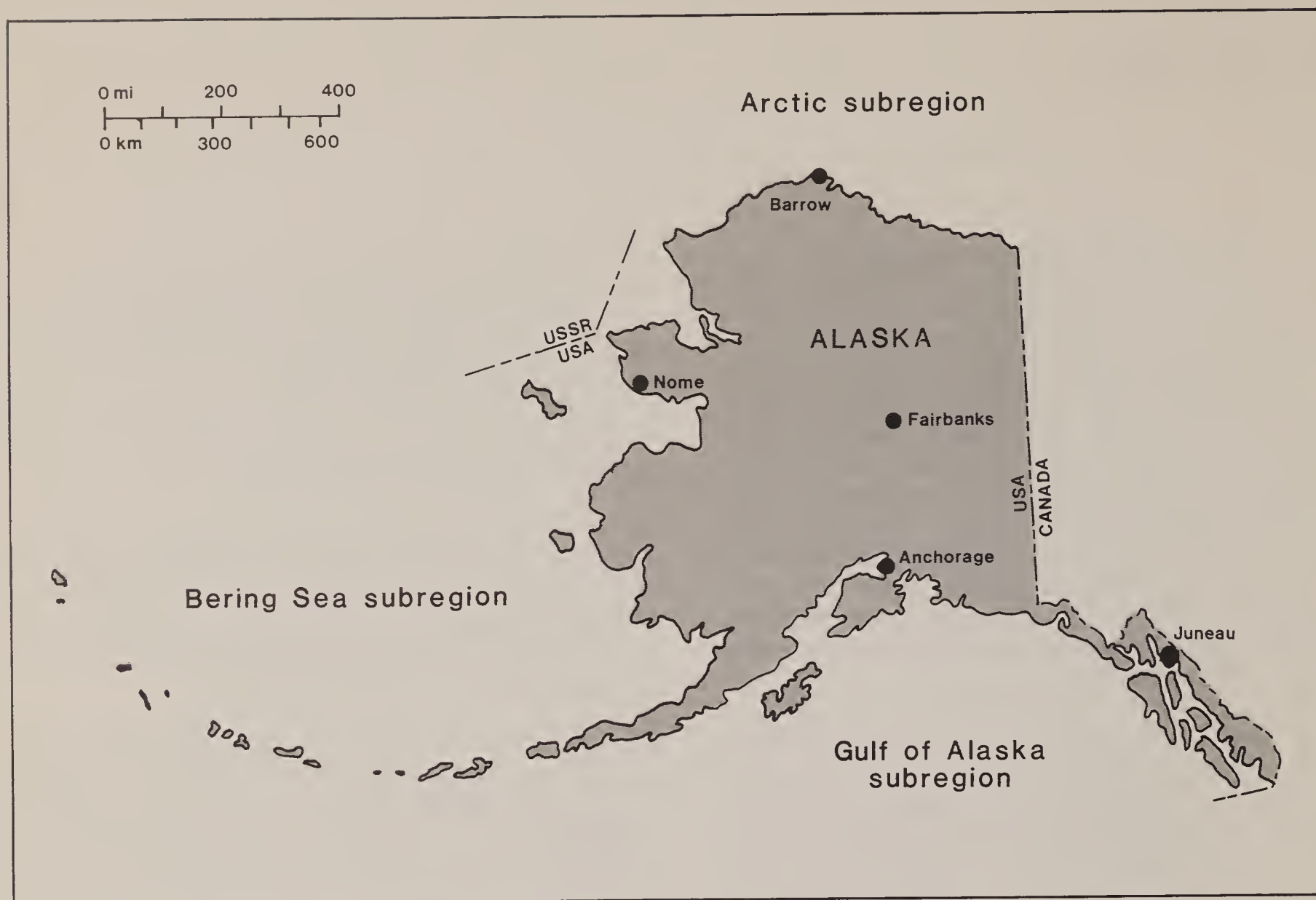


FIGURE 1.--Gulf of Alaska, Bering Sea, and Arctic subregions (adapted from Benton, McDowell, and Conner, 1979, p. 5, and U.S. Department of the Interior, 1980, by Rogers, Golden & Halpern, 1980).

Lower Cook Inlet), the Bering Sea, and the Arctic. To date, Outer Continental Shelf Orders have only been prepared for the Gulf of Alaska (USGS, 1980c). The BLM has divided the State into the same subregions for planning and administrative purposes. A map of these subregions is presented in figure 1. Due to the number of lease sales scheduled for the State, the OCSI will prepare separate reports for each of the three Alaska subregions. This Summary Report thus describes OCS-related activity in the Gulf of Alaska and Lower Cook Inlet (fig. 2).

Alaska has a long history of involvement with oil and gas **onshore** and in **State waters**. As early as 1853, while Alaska was owned by Russia, there were reports of petroleum in the

Cook Inlet area. Claims were staked as early as 1892, and it is believed that the first drilling occurred in 1898 (Barry, 1973). Yet it was not until 1902, in the Gulf of Alaska upland area near Katalla, that a commercial discovery was made. Production continued until 1933, when the small refinery was destroyed by fire. The wells were shut in and never again brought into production. In 1957, another commercial discovery was made on the Kenai Peninsula, in the Swanson River area, by the Atlantic Richfield Oil Corporation. In 1962, the Pan American Petroleum Corporation discovered oil in State waters in Upper Cook Inlet, and by 1969 two refineries had been built at Nikiski, just north of Kenai. There are presently 14 platforms producing oil and gas from State-leased offshore areas in

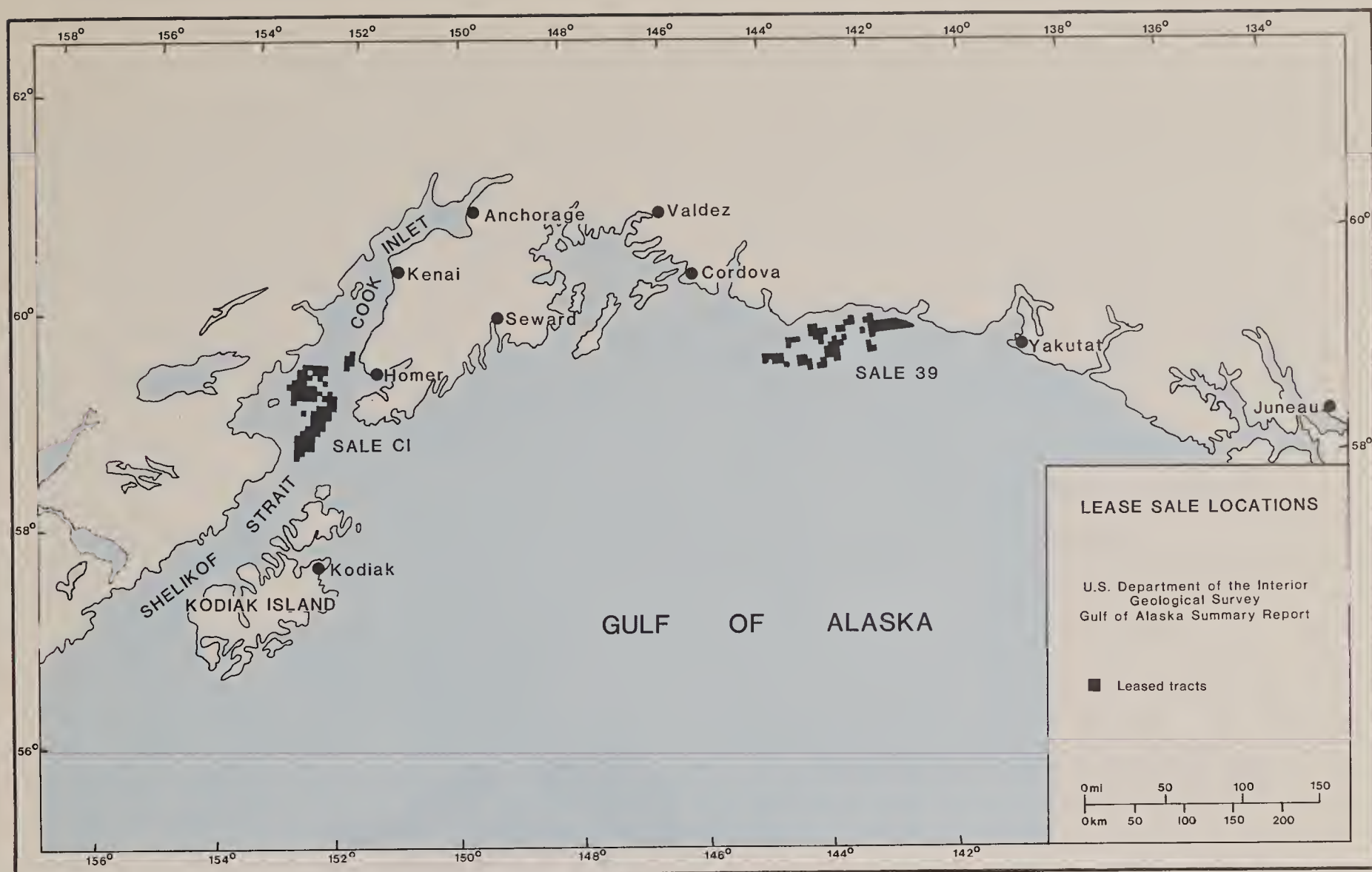


FIGURE 2.--OCS-related activity in the Gulf of Alaska and Lower Cook Inlet (adapted from Alaska Department of Community and Regional Affairs, 1980; BLM, 1976a; and BLM, 1976b by Rogers, Golden & Halpern, 1980).

Upper Cook Inlet. In 1967, the North Slope petroleum fields were discovered onshore in Prudhoe Bay.

Three Alaska **Outer Continental Shelf** lease sales have been held. Two of these have been in the Gulf of Alaska subregion. Lease Sale 39, for the Northern Gulf of Alaska, was held in Anchorage on April 13, 1976, and resulted in the leasing of 76 tracts, totaling 165,543 hectares (409,057 acres). The second sale (Lower Cook Inlet, Lease Sale CI) was held, also in Anchorage, on October 27, 1977, and resulted in the leasing of 87 tracts, totaling 200,448 hectares (495,307 acres). Exploratory drilling on the tracts leased in Sale 39 began in September 1976, and exploratory drilling on tracts leased in Sale CI began in July 1978. No commercial discoveries have been made in either lease sale area to date.

The third Alaska OCS sale--the Federal/State Joint Beaufort Sea Oil and Gas Lease Sale (Sale BF)--was held in Fairbanks on December 11, 1979. Because of litigation, the bids were not accepted until July 11, 1980. A Summary Report of the events pertinent to this sale is being planned.

A number of other OCS lease sales are scheduled to take place in the Region. The 5-year oil and gas leasing schedule for Alaska is given in table 1, and the areas proposed for lease are shown in figure 3. Three of these sales are scheduled for the Gulf of Alaska subregion. Lease Sale 55, in the Eastern Gulf of Alaska, is scheduled for October 1980; Lease Sale 60, in the Lower Cook Inlet and Shelikof Strait, is scheduled for September 1981; and Lease Sale 61, off Kodiak Island, is scheduled for April 1983.

TABLE 1.—Current 5-year oil and gas leasing schedule for Alaska

[illegible]

C - Call for Nominations
D - Nominations Due
T - Tentative Tract Selection
E - Draft Environmental Statement
H - Public Hearing
F - Final Environmental Statement

P - Proposed Notice of Sale
 S - State Comments Due
 R - Energy Review
 N - Notice of Sale
 S - Sale

☆ The holding of the Chukchi Sale at this time is contingent upon a reasonable assumption that technology will be available for exploration and development of the tracts included in the sale.

SOURCE: U.S. Department of the Interior, 1980.

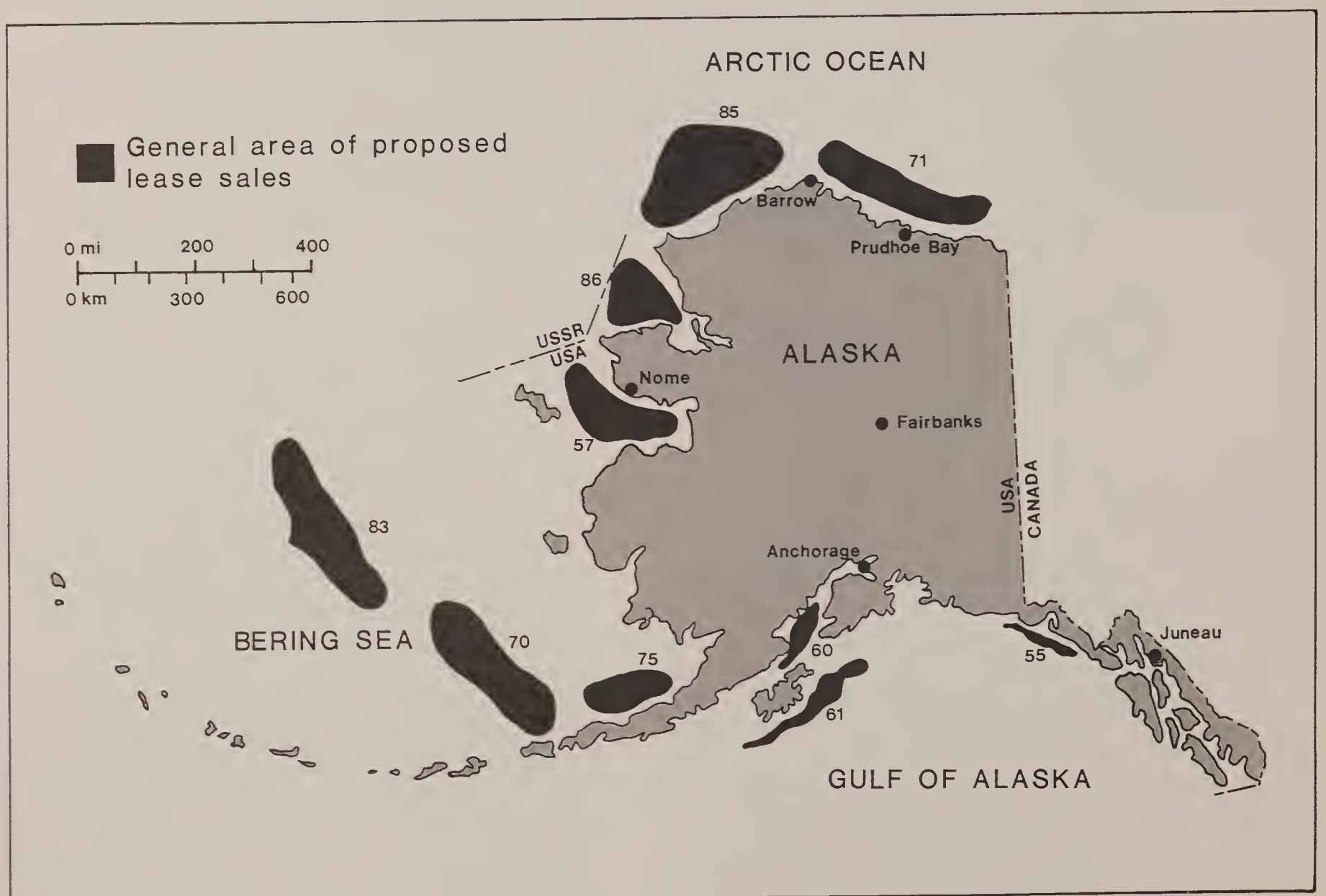


FIGURE 3.--Areas proposed for lease in Alaska, 1980-1985 (adapted from Benton, McDowell, and Conner, 1979; BLM, 1980a; and U.S. Department of the Interior, 1980 by Rogers, Golden & Halpern, 1980).

The revenues produced by lease sales go to the U.S. Treasury Department. OCS revenues are also used to fund the Heritage Conservation and Recreation Service's Land and Water Conservation Fund. Between 1965 and mid-1980, approximately \$21,250,000 was used to fund various projects in Alaska. Ninety percent of this money came from OCS revenues (Clement, 1980, oral commun.).

The Gulf of Alaska Summary Report is designed to assist the State and local communities in planning for future OCS activity. The Report contains descriptions of the OCS-related activity that has occurred to date and projects foreseeable activity. When events warrant, a revised Summary Report will be issued. The first revision of this Summary Report will be made after Lease Sale 55. Approximately every 6 months thereafter, a memorandum describing current levels of activity in the subregion will be distributed. The OCSI staff is available to consult with State agencies if additional information or clarification is requested (telephone: (703) 860-7166).

Each Summary Report produced by the OCSI begins with a chapter presenting the most recent OCS oil and gas resource and reserve estimates. The magnitude and timing of OCS activity are discussed in chapter 2 of the report. The third chapter presents information on oil and gas transportation strategies, including those that are developed as part of the BLM's ongoing Intergovernmental Planning Program (IPP). Chapter 4 describes the nearshore and onshore activities that are occurring and/or probably will occur as a result of current and projected offshore activity for each of the lease sales. Because of the distinctive nature of the two lease sale areas described in this Summary Report, chapters 1, 2, and 4 present general material followed by information specific to each lease sale area. Appendixes provide further detail, and a Glossary presents definitions of geologic, industry-specific, and other special terms used in the report.

Resource and reserve estimates presented in the Summary Report reflect the most recent Federal Government information. The Report is based in part on data collected by

Federal agencies in the course of planning, leasing, and managing the Gulf of Alaska OCS and on studies and reports of OCS activities that have been prepared outside the Federal Government.

Representatives of the OCSI have also discussed oil and gas activities directly with Federal officials, oil industry representatives, State and local officials, and others. In order to identify OCS-related issues and explain the Summary Report process, the OCSI convened a public meeting in Anchorage on March 27 and 28, 1979. The meeting was attended by 44 people, 15 representing State and local governments. Concerns voiced at this meeting and in subsequent interviews and research resulted in the identification of issues to be treated in this Summary Report.

A continuing concern of State and local officials in the Gulf of Alaska subregion is the nature and magnitude of onshore facilities that may locate in or otherwise affect their communities as a result of offshore development. Central to this concern is whether or not the Gulf of Alaska and Lower Cook Inlet have oil and gas in commercial quantities. The Summary Report presents a background for discussion of this issue by explaining what resource estimates mean, how they are derived, what they can be used for, and how the process of estimating resources relates to the process of exploring for oil and gas. This explanation of the nature of resource estimates provides a basis for understanding some of the uncertainties concerning the OCS-related activity in the Gulf of Alaska and Lower Cook Inlet.

As exploration of the Outer Continental Shelf in the Gulf of Alaska and Lower Cook Inlet continues, our knowledge of the subregion's resource potential will improve. In the event of either a discovery of oil or gas in commercial amounts or another lease sale, future editions of the Summary Report will include the most recent resource and reserve estimates, anticipated production curves, transportation strategies, and descriptions of existing and anticipated nearshore and onshore support activity and production facilities.

1. Offshore Oil and Gas Resources of the Gulf of Alaska

Offshore oil and gas resources within a region result from its geologic history and structure. The petroleum geology of the Outer Continental Shelf in the Gulf of Alaska subregion is discussed in this chapter. The first section of the chapter provides a geologic overview. (A detailed discussion is presented in appendix A.) The next two sections summarize geologic features affecting petroleum exploration and development in (1) the Northern Gulf of Alaska and (2) Lower Cook Inlet. The fourth section of the chapter provides a discussion of the various procedures used by the Federal Government to estimate hydrocarbon potential. Information on oil and gas resources and reserves in each of the two OCS lease sale areas (Sale 39 in the Northern Gulf of Alaska and Sale CI in Lower Cook Inlet) is provided in the final section of the chapter.

OVERVIEW OF THE GEOLOGY OF THE SUBREGION

The Gulf of Alaska subregion is contained within two provinces: the **Pacific-Margin Tertiary province** and the **Alaska Peninsula-Cook Inlet province**. Figure 4 shows the extent of these two petroleum provinces and their relationship to the other provinces within the Region.

The Lease Sale 39 area is part of the Pacific-Margin Tertiary province (fig. 4). This basin is a 1,448-km (900-mi) long structure extending from south of Kodiak Island, in the Western Gulf of Alaska, to Cross Sound, in the Eastern Gulf. Plafker (1971) estimated that 103,594 sq km (40,000 sq mi) of onshore and offshore lands within the province are under-

lain by Tertiary rocks, which are potential source rocks for petroleum deposits. The Gulf of Alaska Outer Continental Shelf comprises 85 percent of this area. Subsurface structures that could serve as potential hydrocarbon traps are present on these offshore lands (von Huene, Lathram, and Reimnitz, 1971). However, no commercial discoveries of hydrocarbons have been made to date in offshore areas of the Pacific-Margin Tertiary province.

The Lease Sale CI area in Lower Cook Inlet is part of the 77,695-sq-km (30,000-sq-mi) Alaska Peninsula-Cook Inlet petroleum province. As shown in figure 4, this province extends from Copper River southwestward across Cook Inlet to the Alaska Peninsula. This basin includes a long, narrow wedge of moderately deformed clastic rocks of late Mesozoic age and other rocks of Tertiary age. Commercial accumulations of oil and gas are present in the Tertiary rocks in this basin. These Tertiary rocks, and possibly upper Mesozoic rocks, are believed to have the best potential for future hydrocarbon discoveries (Gryc, 1971).

GEOLOGIC ASPECTS OF THE NORTHERN GULF OF ALASKA

The Northern Gulf of Alaska OCS is within the Gulf of Alaska Tertiary subprovince of the Pacific-Margin Tertiary province. The OCS part of the subprovince comprises approximately 51,797 sq km (20,000 sq mi) of offshore lands.

The major physiographic features of the OCS in the Northern Gulf of Alaska are shown

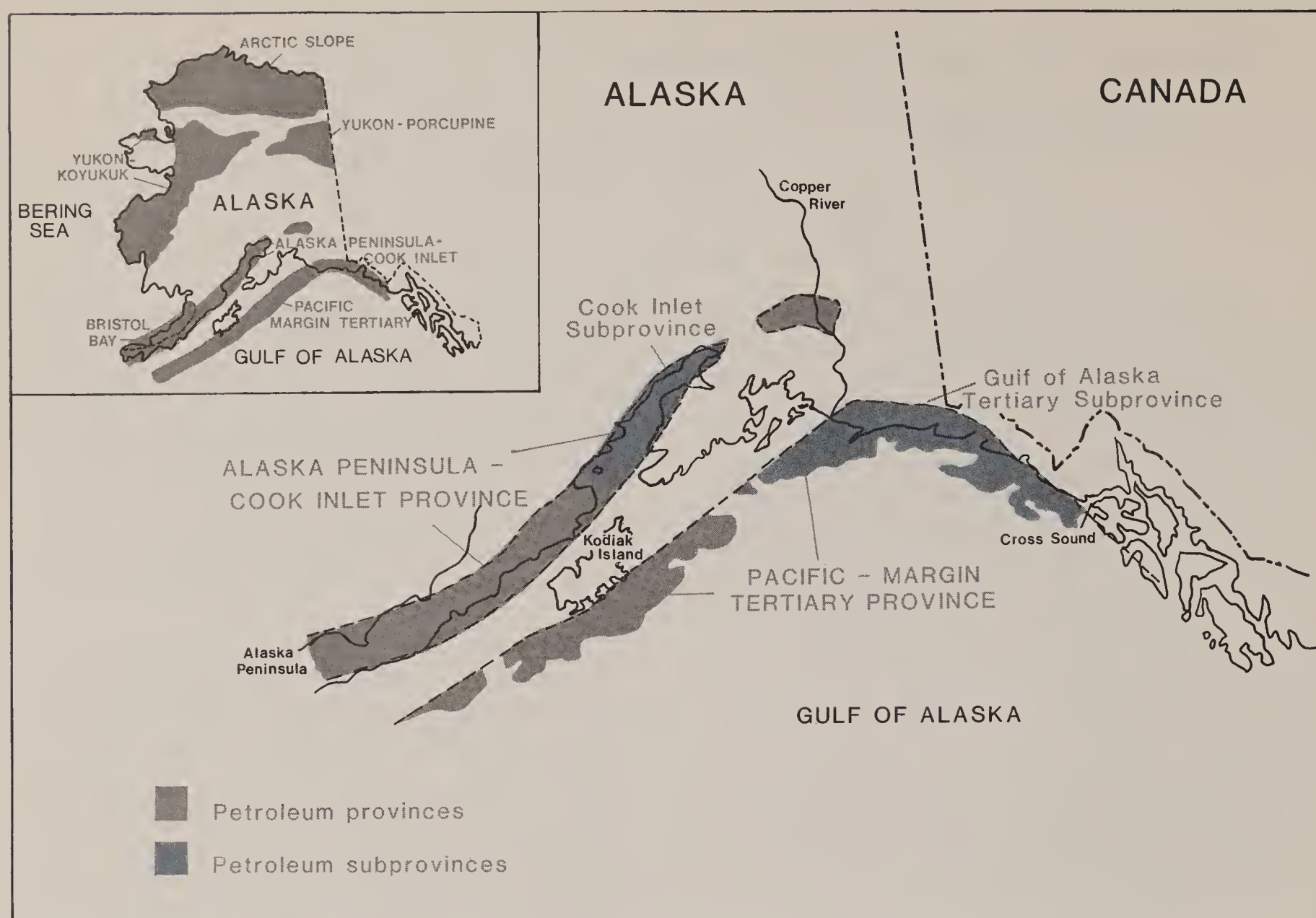


FIGURE 4.--Petroleum provinces of Alaska (redrafted from Gates, Grantz, and Patton, 1968 by Rogers, Golden & Halpern, 1980).

in figure 5. The width of the Continental Shelf varies from 13 km (8 mi) at the eastern end of the area to 105 km (65 mi) in the west. The surface of the OCS is gently undulated, with six clearly defined submarine valleys separating extensive Shelf areas. These valleys are remnants of previous periods of glaciation. The portion of the OCS that is the main focus of this section of the report is the **Yakataga Shelf**, between Kayak Island and Icy Bay. This area was leased during Lease Sale 39 and is the only OCS area in the Northern Gulf of Alaska where exploratory drilling has occurred. Most of this area has a water depth of less than 200 m (660 ft).

Petroleum seepages and petroliferous rocks discovered onshore near the Gulf of Alaska were the first indications of petroleum potential within the subprovince. These petroleum seeps indicated that reservoir sandstones and source rocks might be present offshore, in the Lease Sale 39 area (Jones, 1980). Seismic data collected by USGS geophysicists prior to Lease Sale 39 revealed numerous large structures with demonstrated closures under the Yakataga Shelf and Continental Slope (Plafker and others, 1978). However, recent drilling by oil companies in the Lease Sale 39 area has failed to encounter commercial deposits of hydrocarbons. Dredge samples, together with

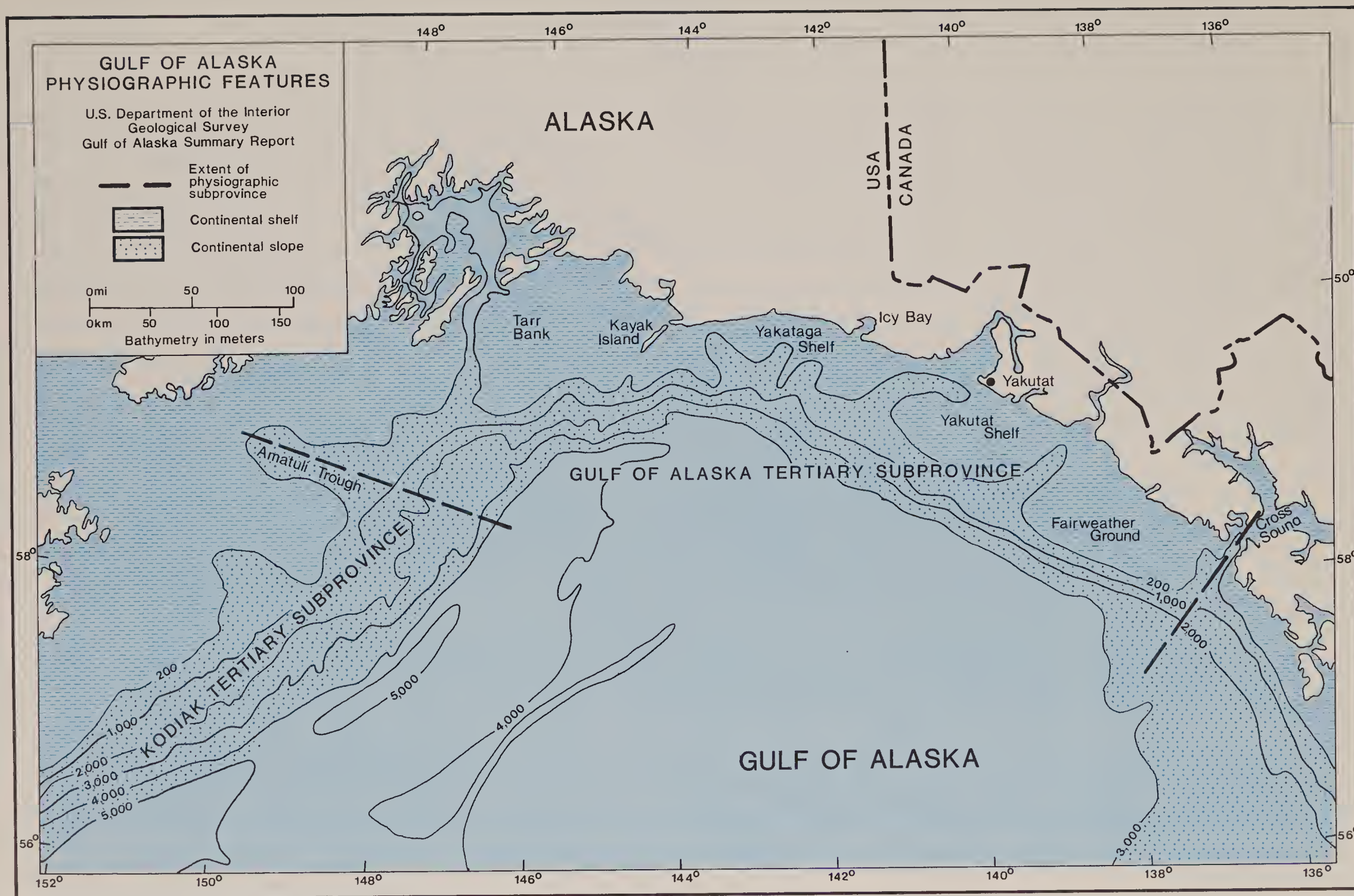


FIGURE 5.—Major physiographic features of the OCS in the Northern Gulf of Alaska (adapted from Plafker, Bruns, and Page, 1975 by Rogers, Golden & Halpern, 1980).

geophysical data, indicate that the structures have a negligible potential for petroleum (Plafker and others, 1978). Most of the known large structures on Yakataga Shelf were tested by exploratory drilling. Based on the drilling record to date and on regional stratigraphic information, the potential for large commercial discoveries from the Yakataga Shelf is currently considered poor (Plafker and others, 1978).

South and east of the Yakataga Shelf is a major untested area called the **Fairweather Ground** of the Yakutat Shelf (fig. 5). The Fairweather Ground subsurface feature has potential for stratigraphic and structural traps along its flanks. This portion of the OCS in the Northern Gulf of Alaska is scheduled to be offered for lease in October 1980 (Sale 55).

The Northern Gulf of Alaska is part of the nearly continuous seismically and volcanically active belt circumscribing the Pacific Ocean. During the last 75 years, five major earthquakes of magnitude 7.8 or greater on the Richter scale have occurred in the Gulf of Alaska area, including the earthquake of 1964 (magnitude 8.4), which had its epicenter in Prince William Sound (BLM, 1980c). Destruction to either offshore or onshore facilities could result from earthquake-associated hazards such as tsunamis (seismic sea waves), landslides, ground breaking and shaking, avalanches, and mud flows. The relative high frequency of earthquakes in the Gulf of Alaska also suggests that future differential movements of the sea floor are probable (BLM, 1980c). Other potential environmental hazards in the Northern Gulf area may include high-pressured, gas-charged sediments; large bedforms; submarine glacial moraines and buried ice; high rates of sedimentation; and onshore glacial lake breakouts.

Failure to identify, avoid, or take proper engineering precautions against these geologic hazards could result in damage to a platform, pipeline, or onshore facility. These conditions may require special engineering or siting procedures, relocation of planned wells, or deletion of tracts from a sale.

GEOLOGIC ASPECTS OF LOWER COOK INLET

The Lower Cook Inlet OCS includes 9,100 sq km (3,500 sq mi) of submerged land in the Cook Inlet petroleum subprovince of the Alaska Peninsula-Cook Inlet province. The water depth on the OCS in Lower Cook Inlet is less than 200 m (660 ft). The Inlet gradually deepens to the south, where it empties into the Gulf of Alaska and the Shelikof Strait. Figure 6 shows the major physiographic and geologic features of the Cook Inlet subprovince.

The Cook Inlet subprovince is part of a belt of Mesozoic-Tertiary sedimentary rocks that extend northeast into Upper Cook Inlet and southwest down the Alaska Peninsula and Shelikof Strait (figs. 4 and 6). A number of northeast-trending anticlinal structures that contain hydrocarbon deposits are present in the northern part of the subprovince. Onshore wells in the area have been producing oil and gas since 1957 (Crick, 1971), and offshore wells in State waters in Upper Cook Inlet have been producing oil and gas since 1963 (Barry, 1973). Data collected by the USGS indicates that Upper Cook Inlet could serve as a structural analog for Lower Cook Inlet (Magoon and others, 1976). Most subsurface folds (anticlines) on the OCS in Lower Cook Inlet parallel the general northeast trend of petroleum-producing structures in Upper Cook Inlet.

A notable exception to this trend is the east-west **Augustine-Seldovia Arch**, a major subsurface structural feature of Lower Cook Inlet (fig. 6). The Augustine-Seldovia Arch forms a hinge about which the entire basin is flexed. Migration from both Upper Cook Inlet and Shelikof Strait could bring petroleum to the vicinity of the Arch (BLM, 1976a). Also, stratigraphic traps could be present in areas where northeast-trending anticlines intersect the Arch.

In a report prepared for the BLM, five potential geologic hazards to oil and gas activities in Lower Cook Inlet were identified (Science Applications, Inc., 1979): seismicity, tsunamis, bedform migrations along the sea floor, shallow faulting, and volcanism.

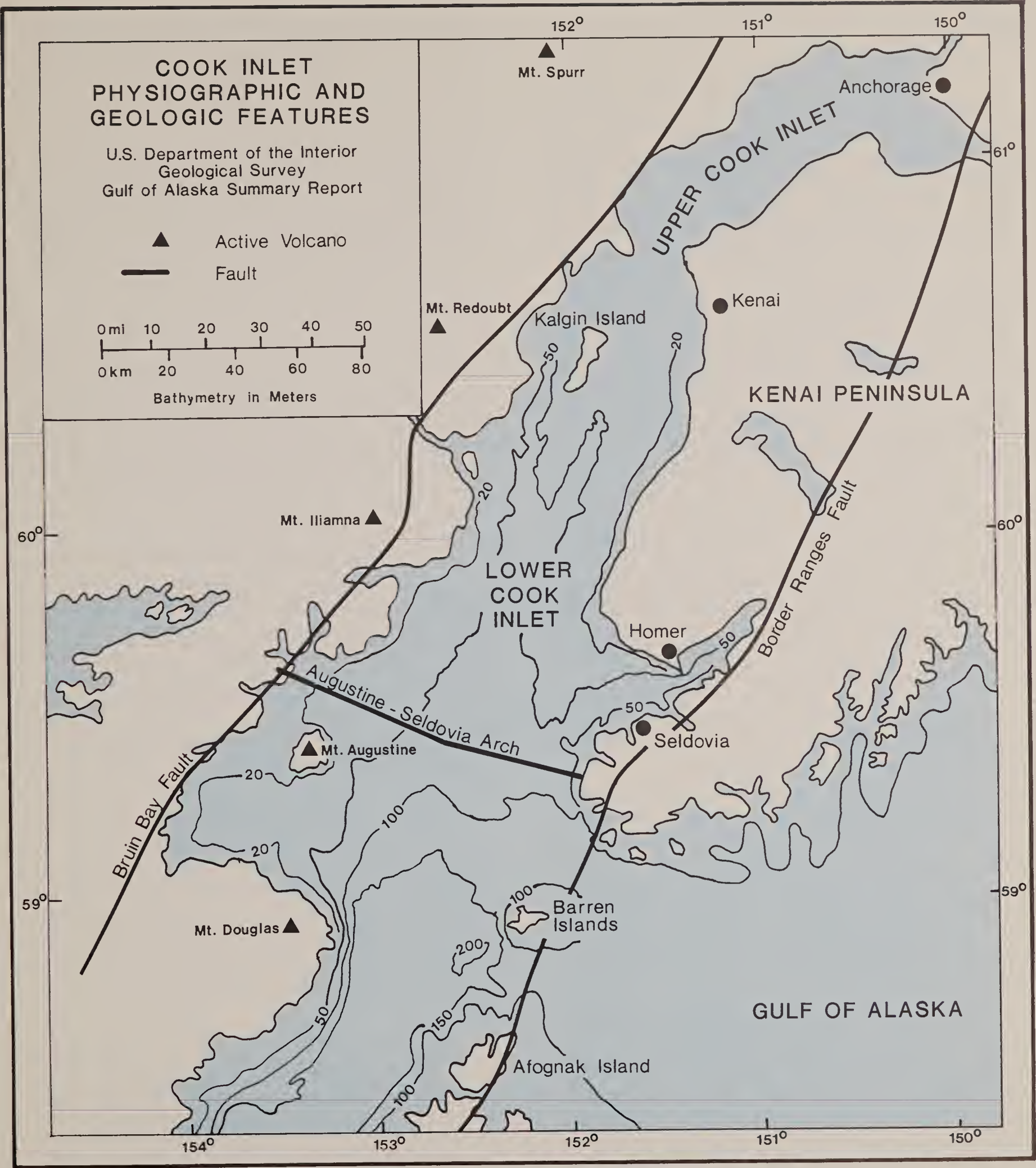


FIGURE 6.—Major physiographic and geologic features in Cook Inlet (adapted from Science Applications, Inc., 1979 by Rogers, Golden & Halpern, 1980).

ESTIMATING HYDROCARBON POTENTIAL

To appreciate the complexities of estimating hydrocarbon potential, one must understand the process by which hydrocarbons are discovered and developed. Until a well has been drilled, investigators derive all their knowledge of subsurface geology indirectly, from geologic and geophysical data collected at the surface. The existence of hydrocarbons can be confirmed only by physical evidence produced by drilling. At this early stage of exploration on the Gulf of Alaska and Lower Cook Inlet OCS, there are no proven fields of oil or gas and it is possible to estimate the Region's potential only in terms of undiscovered resources. **Undiscovered resources** are quantities of oil and gas that have been estimated to exist outside known fields. Estimates of undiscovered resources are made by identifying areas of resource potential on the basis of broad geologic knowledge and theory. Using available data as a basis for further investigations, petroleum geologists then conduct a variety of geologic assessments of the region. The geologists' data base may or may not include physical confirmation of the presence of hydrocarbons by exploratory drilling.

Information added to the geologic and geophysical data base enables geologists to refine resource estimates. However, estimates of undiscovered resources are always matters of interpretation. For the reservoir to be delineated, if it exists, and for its commercial attractiveness to be determined, the area must be extensively explored by further drilling. Normally several wells are drilled in an area where a wildcat strike has occurred before a commercial discovery is confirmed.

After the commercial potential of a reservoir has been established, it is possible to calculate **reserves**. Reserve estimates are estimates of the portion of the identified resource that can be economically extracted. A preliminary estimate of reserves might be based on information obtained from several wells, or conceivably from a single well, and a map of the subsurface geology.

Estimates of reserves allow us to ap-

In estimating resources, certain assumptions are often made. For example, a resource estimate conditioned by the word **recoverable** takes into account the fact that physical and technological constraints dictate that only a portion of resources or reserves can be brought to the surface. An estimate of **economically recoverable** resources takes into account the cost of exploration and development and the market price of oil and gas. A third uncertainty stems from the probability that resources are, or are not, present in a given area. A **risked** resource estimate is one that has been modified according to the estimator's confidence in the estimate (i.e., "risked" to account for the probability that economically recoverable resources will actually be encountered within the area of interest).

proximate more nearly the level of development activity that can be expected in an area than do risked estimates of economically recoverable resources. Site-specific planning for OCS development and production that a State and local government undertakes should be based on reserve estimates, once a commercial discovery has been made. In the absence of a reserve estimate, the most appropriate figure to use is the estimate of **risked, economically recoverable resources**. This is a much less firm number, but it is the most useful resource estimate for general--as opposed to site-specific--planning because it has been modified by the likelihood of finding hydrocarbons in an area, as well as by the likelihood of any discovery being commercially attractive.

For additional information on the process of resource estimation, the reader may consult appendix B, which explains in greater detail how resource estimates are derived, what they mean, what they should be used for, and how the process of estimating resources relates to the process of exploring for oil and gas.

Factors involved in site-specific planning are the size of the discovery, the proportions of oil and gas (and the type of oil), seabed depth and conditions, weather, coastal environment and capabilities, market locations, transportation systems and costs, interaction among oil companies, planning mechanisms, and political attitudes. The complexity and number of these factors means that site-specific planning is usually not undertaken until after a commercial discovery is made.

RESOURCE AND RESERVE ESTIMATES FOR THE GULF OF ALASKA AND LOWER COOK INLET

The USGS's March and June 1980 resource and reserve estimates for the Gulf of Alaska, for Lower Cook Inlet, and for the offshore areas currently under lease in the Lease Sale 39 and CI areas are presented in table 2.

The undiscovered recoverable resource estimates for the Gulf of Alaska and for Lower Cook Inlet are given in the first two lines of the table. They provide a measure of the petroleum potential of the two geological subprovinces. It is important to understand that these estimates are based on interpretation of broad-scale geologic data and there-

fore provide only a first approximation of the total hydrocarbon potential of the two OCS areas.

The risked estimates of economically recoverable resources are given next. They cover only tracts currently leased in the Northern Gulf of Alaska (2 tracts) and Lower Cook Inlet (87 tracts). The estimates are based on the following information:

- the results of drilling 20 wells (10 exploratory wells and 1 Continental Offshore Stratigraphic Test (COST) well in the Northern Gulf of Alaska lease sale area, and 8 exploratory wells and 1 COST well in the Lower Cook Inlet lease sale area), plus seismic data;

TABLE 2.—Gulf of Alaska and Lower Cook Inlet OCS oil and gas resource and reserve estimates

	Oil (million barrels)	Gas (billion cu ft)
Undiscovered recoverable resources		
Gulf of Alaska (water depth 0-2400 m)	400	2,200
Lower Cook Inlet (water depth 0-200 m)	400	2,200
Risked, economically recoverable resources		
Northern Gulf of Alaska leased lands (2 offshore tracts)	negligible	negligible
Lower Cook Inlet leased lands (87 offshore tracts)	35	26
Reserves		
Northern Gulf of Alaska	0	0
Lower Cook Inlet	0	0

SOURCES: USGS, Geologic Division (unconditional recoverable resource estimates), October 1980; USGS, Conservation Division (risked, economically recoverable resource estimates and reserve estimates), June 1980.

- the number of tracts currently under lease; and
- an assumption that the potential geologic traps that have been identified contain risked, economically recoverable quantities of hydrocarbons.

These risked estimates are much lower than those provided in the Environmental Impact Statements for the two sale areas. This is so primarily because the Summary Report estimates apply specifically to the tracts currently under lease. The EIS estimates are for all lands proposed for a given sale (see chapter 2).

Reserve estimates approximate the cumulative production that can be expected from a discovery. The entry for reserves is zero at this time for both the Northern Gulf of Alaska OCS and the Lower Cook Inlet OCS because no discovery of oil or gas in commercial amounts has yet been made in either area.

The estimates provided here were formulated in June 1980. They represent the latest information available on the petroleum potential of the two OCS lease sale areas in the Gulf of Alaska subregion. Exploration activities in both areas are summarized in chapter 2.

2. Magnitude and Timing of Offshore Development

This chapter provides a summary of exploration activities in each of the two Federally leased areas in the Gulf of Alaska subregion. After this introductory overview, the Northern Gulf of Alaska area (Sale 39) and the Lower Cook Inlet area (Sale CI) are discussed separately in detail.

Geophysical surveys in the Gulf of Alaska subregion were initiated in 1967. Exploration for oil and gas on the OCS began during 1976 in the Gulf of Alaska and during 1978 in the Lower Cook Inlet. A total of 10 exploratory wells have been drilled on eight structures in the Northern Gulf of Alaska; 8 exploratory wells have been drilled on seven structures in Lower Cook Inlet. No commercial deposits have been discovered in any of the wells drilled in either area. At this time, exploration has stopped and no further Applications for Permit to Drill (APD's) have been submitted for either of the two leased areas.

OFFSHORE DEVELOPMENT IN THE GULF OF ALASKA

On July 22, 1975, prior to the first lease sale in the subregion, a Continental Offshore Stratigraphic Test (COST) well was drilled on block 196 in the northern part of the Gulf of Alaska, 48.3 km (30 mi) southwest of Cape Yakataga. The well was drilled under a USGS permit issued to a group of 26 oil companies for purposes of providing geologic data before submitting bids for Lease Sale 39. The Glomar

Conception rig drilled the well to a depth of 1,555 m (5,100 ft) before plugging and abandoning it on October 9, 1975.

Before Lease Sale 39, the State of Alaska filed suit against the Secretary of the Interior in the U.S. District Court in the District of Columbia, seeking a preliminary injunction to delay the sale (State of Alaska, et al. v. Kleppe, Secretary of the Interior, U.S.D.C., 76-0368). In the suit, the State challenged the adequacy of the Environmental Impact Statement (EIS) filed by the Department of the Interior for the proposed sale. The reasons cited by the State included the failure of the EIS to consider onshore impacts; inadequate cooperation by the Department of the Interior with State and local governments; inadequate consideration of OCS Operating Orders; and the exclusion of a lease termination clause in the discussion of alternatives. A motion for a preliminary injunction to delay the sale was denied on April 6, 1976. The State subsequently filed an emergency appeal to the Court of Appeals in the District of Columbia seeking injunctive relief pending appeal. The Court of Appeals denied the request on April 12, 1976, and returned the case to the District Court for trial on its merits. Lease Sale 39 occurred as originally scheduled on April 13, 1976.

The case was not heard by the District Court until August 3, 1976. On August 13, 1976, the District Court dismissed the State of Alaska's complaint and held that the EIS met the requirements of the National Environmental Policy Act (NEPA). The State subsequently appealed this decision. The District of

Columbia Court of Appeals heard the arguments for the case on January 17, 1977. The final decision was made on February 24, 1978 (*State of Alaska, et al. v. Cecil D. Andrus, et al.*, C.A.D.C. 76-1829). In the decision, the Court of Appeals granted declaratory relief and remanded the case to the Secretary of Interior for consideration of the environmental impacts of alternative operating orders. However, the Court denied the State's request to set aside the lease sale and enjoin exploratory drilling already under way in the Gulf of Alaska. No appeal was made by the Department of the Interior.

As noted above, Lease Sale 39 was held on April 13, 1976. Of a total of 186 tracts offered, 76 tracts, representing 165,543 hectares (409,057 acres), were leased by 20 oil companies for a total of \$560 million (BLM, 1976b). Figure 7 shows the locations of the leased tracts, the COST well, and the exploratory wells drilled to date within the Sale 39 area. Table 3 gives the tract numbers, OCS lease numbers, and block numbers of all tracts leased and drilled on in Sale 39.

Five stipulations were attached to the leases for the purpose of minimizing adverse impacts that might occur as a result of exploration activities. The first stipulation was applicable to all leases and addressed several

factors: protection of archeological resources; location of drilling equipment so as not to interfere with commercial fishing operations or marine mammal and bird rookeries; the operating effectiveness of pollution equipment; and protection of biotic communities. The second stipulation placed restrictions on activities on certain tracts located within 4 nautical miles of the shoreline. The third and fourth stipulations placed restrictions on production platform locations in areas potentially subject to mass movement (slumping) of sediments. The fifth stipulation was attached to all leases and required the lessee to submit to the State and local jurisdictions a "Notice of Support Activity for the Exploration Program." The notice is intended to assist coastal communities in planning for impacts resulting from exploration activities. It includes a description of facilities to be used in connection with exploration activities, as well as personnel requirements and residency information, estimated supplies needed, and frequency of vessel and helicopter trips (Federal Register, March 12, 1976).

Shell Oil Company was the first company to begin exploratory drilling on the Gulf of Alaska OCS. Drilling began on block 106 on September 1, 1976. The well was dry and was plugged and abandoned on January 28, 1977.

Four other companies conducted drilling operations in the Northern Gulf of Alaska: Atlantic Richfield Company, Exxon Company, Gulf Oil Company, and Texaco, Inc. ODECO's Ocean Ranger, a semisubmersible rig that drilled for Atlantic Richfield Company, is pictured in figure 8. Figure 9 provides an activity log of drilling operations conducted by the five companies. The log shows the rigs involved and their respective periods of drilling activity. The greatest exploratory activity on Sale 39 tracts occurred during the spring and summer of 1977.

All the exploratory wells drilled in the Gulf of Alaska have been dry. The last well drilled in the area was abandoned on July 1, 1978. No wells have been drilled since, and no further Applications for Permit to Drill (APD's) have been submitted.

TABLE 3.—Companies, tract numbers, OCS lease numbers, and block numbers for tracts leased and drilled on -- Lease Sale 39

Company	Tract number	OCS lease number	Block number
ARCO-Shell	39-30	Y0007	072
Shell	39-42	Y0011	106
ARCO-Shell	39-47	Y0014	111
Texaco	39-78	Y0032	162
Exxon	39-81	Y0035	165
Texaco	39-116	Y0046	241
Exxon	39-126	Y0050	284
Gulf	39-142	Y0059	329
Exxon	39-169	Y0072	414
Exxon	39-204	Y0080	343

SOURCE: BLM, 1977.

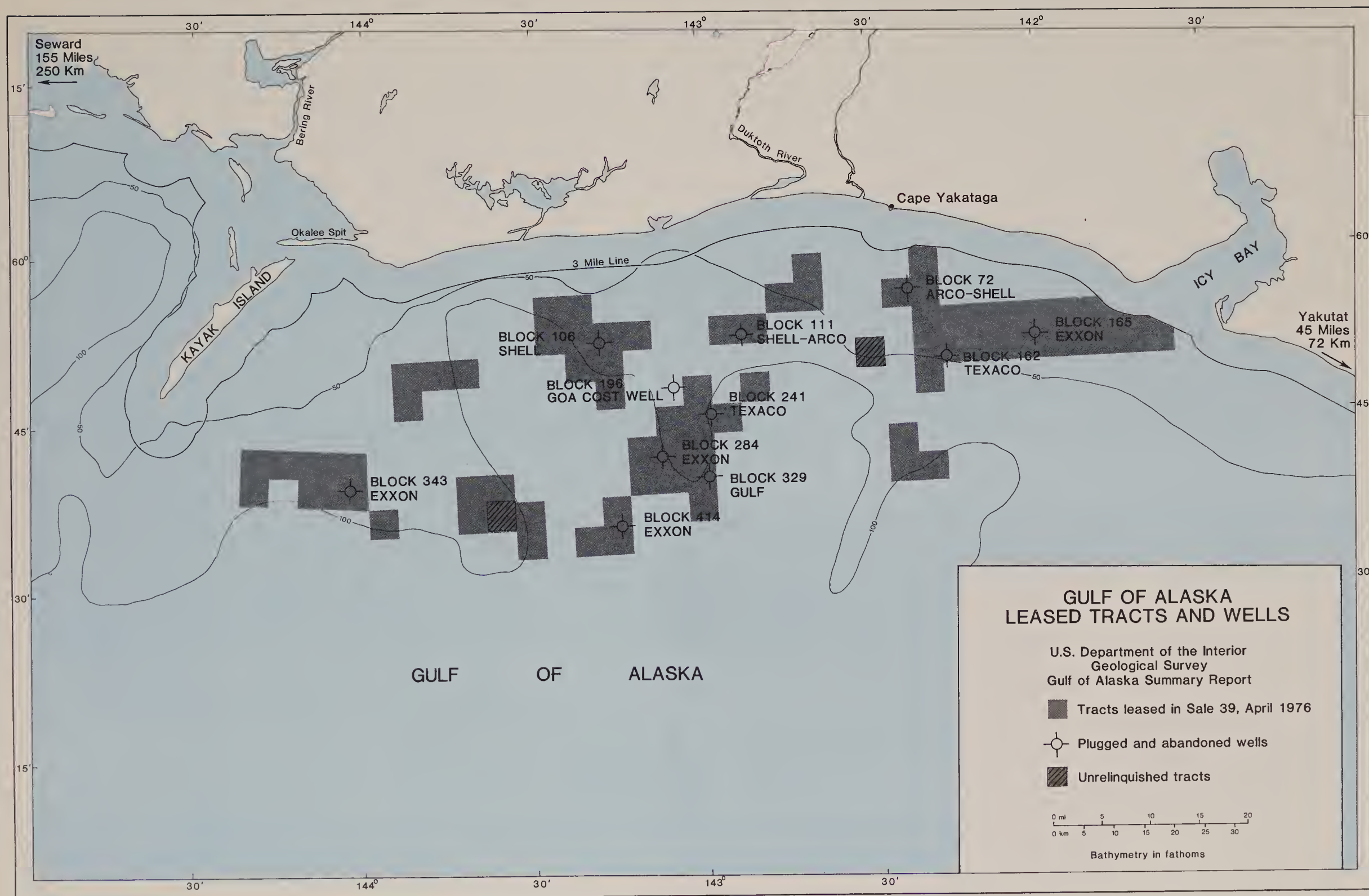


FIGURE 7.--Leased tracts and wells in the Lease Sale 39 area (Northern Gulf of Alaska) (redrafted from USGS, 1980a by Rogers, Golden & Halpern, 1980).

as one of the most promising hydrocarbon-bearing provinces in the entire North American OCS. The EIS prepared for Lease Sale 39 shared this optimistic view, projecting a possible course of development for the Northern Gulf of Alaska OCS based upon then-current high resource estimates. In the EIS, it was estimated that if hydrocarbons were found, the tracts offered in the lease sale would yield from 0.1 to 2.8 billion barrels of oil and from 0.3 to 9.0 trillion cubic feet of gas. It was further projected that development could involve as many as 22 platforms, 800 wells, and 483 km (300 mi) of pipeline, as well as 5 onshore terminals, one of which would be a liquified natural gas (LNG) plant (BLM, 1976b).

For several reasons, resource estimates on which the EIS development scenario was based are not comparable to the resource estimates presented in this Summary Report. First, the estimates presented in this report

are more recent. They are based on much more data than was available at the time the EIS was prepared and include the results of the 11 wells drilled on the Northern Gulf of Alaska OCS. Second, the geographic area covered by the EIS was substantially larger than that covered by this Summary Report. The EIS estimates covered all lands initially proposed for lease in Sale 39 (330 tracts, representing 728,451 hectares, or 1,800,002 acres); the estimates presented in this report cover only the offshore lands that are still under lease (2 tracts of the 76 originally leased). Third, the estimation procedure used for the EIS tends to produce larger estimates of resources than the process used for obtaining the Summary Report estimates. The EIS estimates were developed primarily for hypothesizing development scenarios, which were then used as a basis for assessing potential environmental impacts. Given the more recent resource estimates, production of oil from the two tracts currently

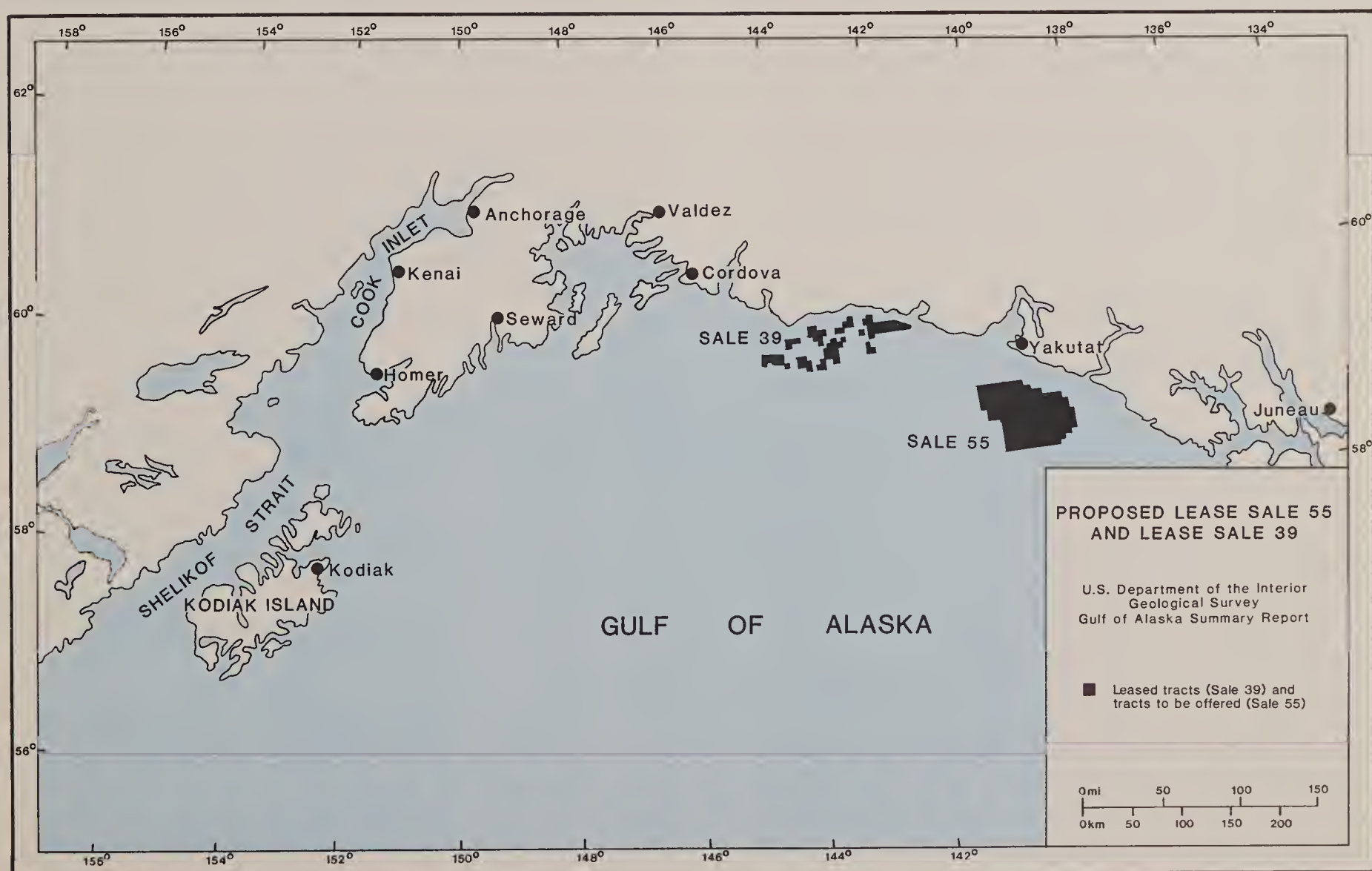


FIGURE 10.—Proposed Lease Sale 55 area in relation to Lease Sale 39 area (adapted from Alaska Department of Community and Regional Affairs, 1980; BLM, 1976b; and BLM, 1980c; and BLM, June 1980, unpublished data by Rogers, Golden & Halpern).

under lease is not expected. Appendix B provides a more detailed explanation of the various methodologies used in estimating oil and gas resources.

Two lease sales are scheduled in the Gulf of Alaska during the next 5 years. Sale 55, in the Eastern Gulf of Alaska, is scheduled for October 1980. The Final Environmental Impact Statement (FEIS) for the proposed sale, covering 350 blocks totaling 792,085 hectares (1,957,242 acres) of OCS lands, was completed in March 1980 by the Bureau of Land Management (BLM, 1980c). In June 1980, the Secretary of the Interior published a proposed notice of sale for 210 tracts (45 FR 37895). A final notice of sale was published in September 1980 (45 FR 59750).

Lease Sale 61, in the Western Gulf of Alaska (Kodiak Basin), is scheduled for April 1983. Sale 61 replaces Sale 46, previously scheduled for July 1980, which was deleted by the Secretary of the Interior as a result of the area's low resource potential, the limited interest of the oil and gas industry, and the concerns voiced by the residents and officials of the Kodiak area. Sale 61 will include some of the same area originally scheduled for Sale 46. However, due to the new leasing schedule, the entire leasing process will be repeated. The Call for Nominations for Lease Sale 61 was issued in September 1980 (45 FR 62909).

OFFSHORE DEVELOPMENT IN LOWER COOK INLET

Drilling activity on the Lower Cook Inlet OCS began with the COST well drilled in June 1977. However, it was preceded by litigation over leasing of OCS lands. Litigation began in 1967, when both the State of Alaska and the United States claimed title to the submerged lands in the lower portion of the Inlet. The State's claim to the offshore lands was based on the historic bay concept, which provides for State ownership of the submerged land if the coastal nation traditionally asserts and maintains dominion over the lands with the acquiescence of foreign nations. The United States claimed that the lower portion of the Inlet

constituted high seas. This dispute was resolved by the U.S. Supreme Court in June 1975 (United States v. State of Alaska 73-1388 U.S.). The court ruled that the State had insufficient evidence to establish Cook Inlet as a historic bay and that the U.S. had paramount rights to the submerged land in the lower, or seaward, portion of Cook Inlet.

A second legal dispute occurred during 1977 when the English Bay Village Corporation, a native corporation established by the Alaska Native Claims Settlement Act (ANCSA), filed suit against the Secretary of the Interior, alleging that the EIS for the proposed Lease Sale CI did not meet the requirements of NEPA (English Bay Village Corporation v. Secretary of the Interior, Civil No. 77-174.) The Corporation claimed the document did not adequately discuss potential impacts to the English Bay community and failed to address the long-term impacts of onshore support facilities on Lower Cook Inlet fisheries. Interior Secretary Andrus postponed the sale from February 1977 to October 1977 to study the Corporation's claim. The sale was held without a final decision on the case. A settlement was entered for amicable resolution of the suit and the case was dismissed in March 1978. As a result of the settlement agreement, the USGS will be required to prepare the first development-phase EIS for Lower Cook Inlet leases when and if a commercial discovery is made. The settlement also required the Department of the Interior to develop a study on the possible toxicity of drilling muds with regard to organisms in the Lower Cook Inlet and to issue notices of receipt of Development Plans for Lower Cook Inlet in the Federal Register. Additionally, the Department of the Interior is required under the settlement to use "the best available and safest technology" that is economically achievable, without regard to the economic condition of the lessees (English Bay Village Corp., et al., v. Secretary of the Interior, et al., 1978).

The first well drilled on the Lower Cook Inlet OCS was a COST well, which was spudded (started) on June 10, 1977, in block 789. The well was drilled by Atlantic Richfield Company using ODECO's semisubmersible rig,

the Ocean Ranger, shown in figure 8. It was drilled to a depth of 3,776 m (12,387 ft) before being abandoned on September 26, 1977. The well provided pre-lease sale information of stratigraphic and lithologic conditions on the Lower Cook Inlet OCS to the participating companies, as well as the USGS.

The Lower Cook Inlet lease sale, Sale CI, was held on October 27, 1977. Of the 135 tracts offered, 87 were leased, a total of 200,448 hectares (495,307 acres). The sale attracted considerable attention as one of the initial tests of a variation on the usual bidding method. Two-thirds of the tracts were offered under the traditional cash bonus method, while the remaining one-third were offered for a fixed cash bonus, with royalty bidding. Thirty-one companies participated in the bidding: 57 tracts were leased for cash bids and 30 tracts for royalty bids. Figure 11 shows the locations of the tracts leased in Sale CI. Table 4 gives the tract numbers, OCS lease numbers, and block numbers of all tracts leased and drilled on in Sale CI.

Nine stipulations were attached to the leases in order to minimize adverse impacts that might result from exploration activities. These stipulations included requirements similar to the stipulations for Lease Sale 39, discussed in the previous section. An additional requirement placed on lessees included the development of an environmental training program for all personnel involved in exploration or development activities.

TABLE 4.—Companies, tract numbers, OCS lease numbers, and block numbers for tracts leased and drilled on -- Lease Sale CI

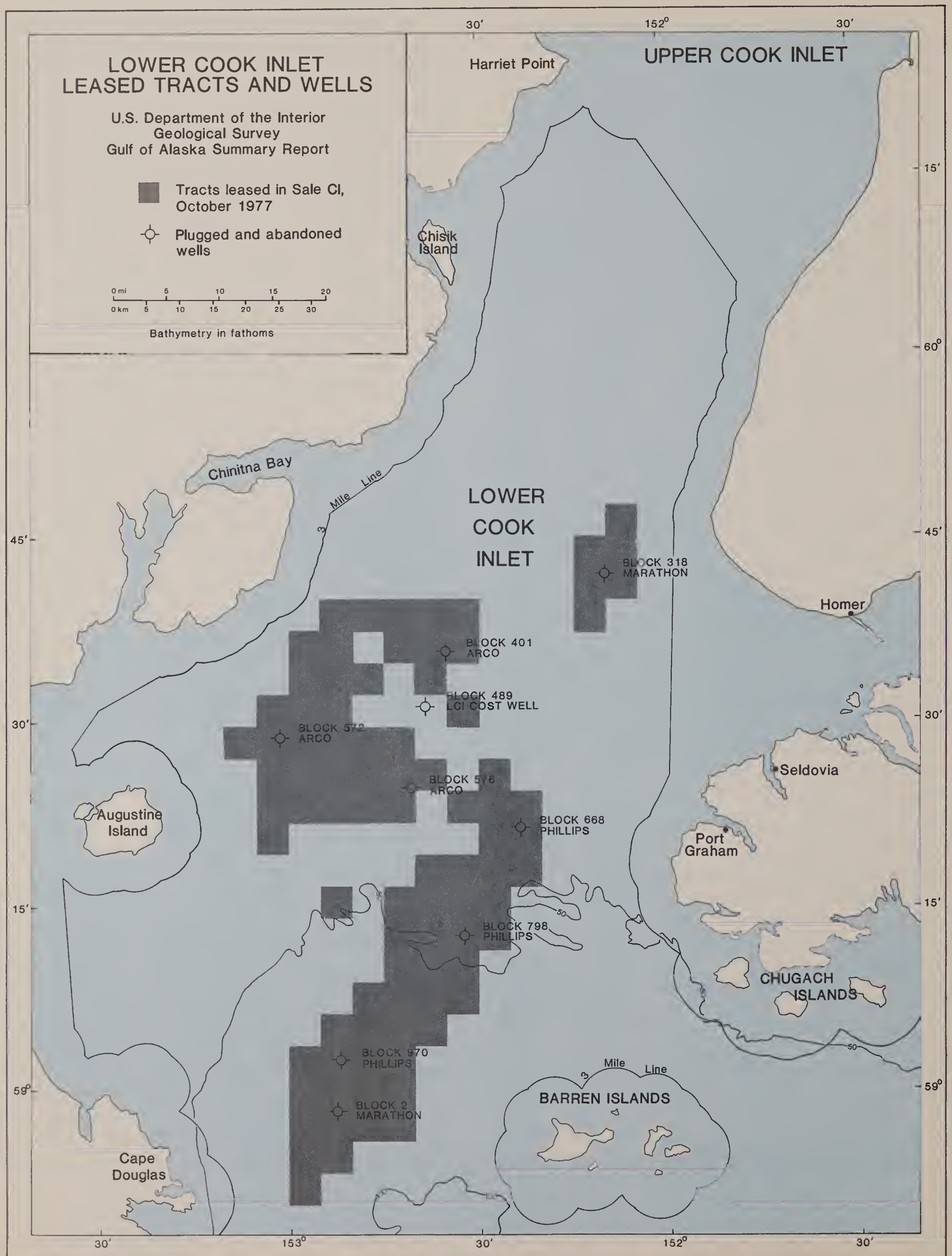
Company	Tract number	OCS lease number	Block number
Marathon	CI-14	Y0086	318
ARCO	CI-28	Y0097	401
ARCO	CI-63	Y0113	576
Phillips	CI-85	Y0124	668
Phillips	CI-109	Y0136	798
Phillips	CI-128	Y0152	970
ARCO	CI-138	Y0161	572
Marathon	CI-147	Y0168	002

SOURCE: BLM, 1976c.

Marathon Oil Corporation was the first company to begin exploratory drilling on the Lower Cook Inlet OCS. The well was spudded on July 21, 1978, in block 318, in the northernmost section of the lease sale area. It had a show of oil in noncommercial volumes between 2,865 and 3,065 m (9,400 and 10,057 ft) (Petroleum Information, December 20, 1978). The well was plugged and abandoned on December 22, 1978. Figure 11 shows the location of this well, the subsequent exploratory wells, and the COST well.

Marathon has also completed one well on block 2, at the southern end of the lease sale area. Two companies other than

Bidding systems that can be used for leasing tracts on the OCS are set forth in Section 8 of the OCS Lands Act, as amended. The Notice of Sale, which appears in the Federal Register prior to each lease sale, specifies the bidding system or systems to be used on specific tracts. The choice of bidding systems may affect the amount of economic and physical recovery of the resources and the level of competition. The **fixed royalty-variable cash bonus** system ("bonus" bidding) is the traditional method of bidding on tracts. A fixed royalty percentage and minimum cash value per hectare (or acre) is announced in the Notice of Sale. The cash bonus is the bid variable. The **fixed bonus-variable royalty** system is commonly called "royalty" bidding. This type of bidding includes a fixed minimum cash bonus per hectare per tract and uses the royalty as the bid variable. A minimum royalty percentage is set on tracts designated for royalty bidding. High bids are determined by the highest royalty percentage bid on the tract. This type of bidding may require a much smaller initial outlay of cash at the time of bid submission than "bonus" bidding. Under the **fixed cash bonus with sliding-scale royalty** system, the cash bonus is the bid variable and the royalty rate is based on the realized value of lease production during each calendar quarter. The royalty rate is fixed according to a sliding-scale formula described in the Notice of Sale. The **fixed net profit share** is the newest bidding system. It was first tried in Sale A62 in the Gulf of Mexico in September 1980. Final regulations concerning fixed net profit share bidding were published by the Department of Energy in the Federal Register on May 30, 1980. This bidding system uses the cash bonus as the bid variable and requires a fixed annual rental payment and net profit share payments at a rate that is constant for the duration of the lease. The system is intended to allow the lessee to recover expenses of exploration and development, plus a reasonable return on that investment, from production revenues before paying any net profit share to the Federal Government. This differs from the fixed royalty system, in which payments to the Government begin with the first barrel of production.



◀ **FIGURE 11.**--Leased tracts and wells in the Lease Sale CI area (Lower Cook Inlet) (redrafted from USGS, 1980b, by Rogers, Golden & Halpern, 1980).

Marathon have been active in Lower Cook Inlet. Using the Ocean Bounty semisubmersible (fig. 12), Phillips Petroleum Exploration has drilled an exploratory well in each of three blocks. All three wells were dry. Atlantic Richfield Company has also drilled three wells on the Lower Cook Inlet OCS. The first well was dry. The second well had a show of oil, but the show was not commercially significant and the well was plugged and abandoned (Petroleum Information, June 4, 1980). The third well was dry and was plugged and abandoned on June 28, 1980. No further APD's have been

submitted; however, none of the tracts originally leased during Sale CI have been relinquished.

Figure 13 provides an activity log of drilling operations in Lower Cook Inlet to date, showing well depth plotted against time for each well drilled and the periods of activity for each of the rigs involved in drilling. During one 5-week period (July 15 to August 21, 1979), all three companies were drilling at the same time. Throughout most of the exploration phase, two rigs were operating simultaneously in the Inlet.

The EIS prepared for Lease Sale CI provided estimates of recoverable oil and gas resources and projected a possible course of development based on these estimates. The estimates for the sale area ranged from 0.9 to



FIGURE 12.--The Ocean Bounty semisubmersible rig, which drilled for Phillips Petroleum in Lower Cook Inlet from October 1978 to April 1980 (photograph by Maurice Lynch, USGS Conservation Division, Anchorage, Alaska).

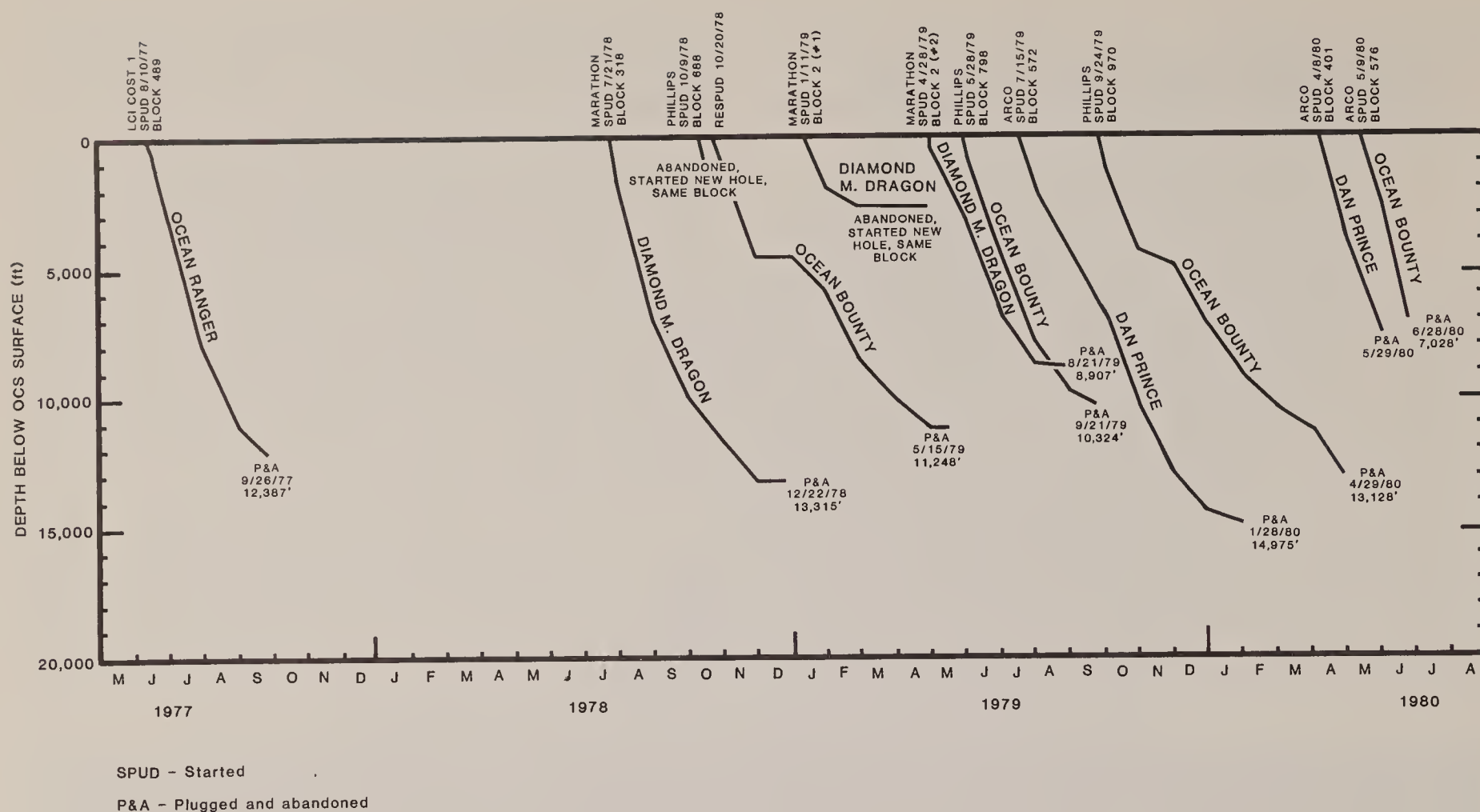


FIGURE 13.--Activity log of drilling operations conducted in Lower Cook Inlet (redrafted from Lynch, 1980 by Rogers, Golden & Halpern, 1980).

2.6 billion barrels of oil and from 0.6 to 3.3 trillion cubic feet of gas. At this level of production, 23 platforms and a total of 483 km (300 mi) of pipelines would have been necessary. Onshore, two new terminals and two new treatment facilities would have been required, with the rest of production going to existing onshore facilities (BLM, 1976a).

The estimates used in the EIS differ from the estimates provided in this report for the same reasons discussed in the section on the Lease Sale 39 estimates (pp. 19 to 20). On the basis of the new resource estimates provided in this report, production of oil or gas from the currently leased tracts is unlikely.

Additional areas in Lower Cook Inlet are proposed for the upcoming Lease Sale 60, scheduled for March 1981. The Sale 60 area includes submerged lands surrounding the tracts leased during Sale CI, as well as tracts in the Shelikof Strait. Figure 14 shows the

extent of the area proposed for sale. Resource Reports have been submitted for the Sale 60 area, and the pre-sale Draft Environmental Impact Statement (DEIS) has been prepared by BLM's Alaska OCS Office (1980b).

CONCLUSION

Despite the lack of commercial hydrocarbon discoveries in either Lower Cook Inlet or the Northern Gulf of Alaska, planning for potential oil and gas development is ongoing in both areas. The lack of current drilling activity suggests that the initial optimism of the oil companies has been somewhat dampened. But the exploration results to date neither prove nor disprove the existence of hydrocarbons in the Gulf of Alaska OCS. Many wells will have to be drilled before the resource potential of the area is established: in the

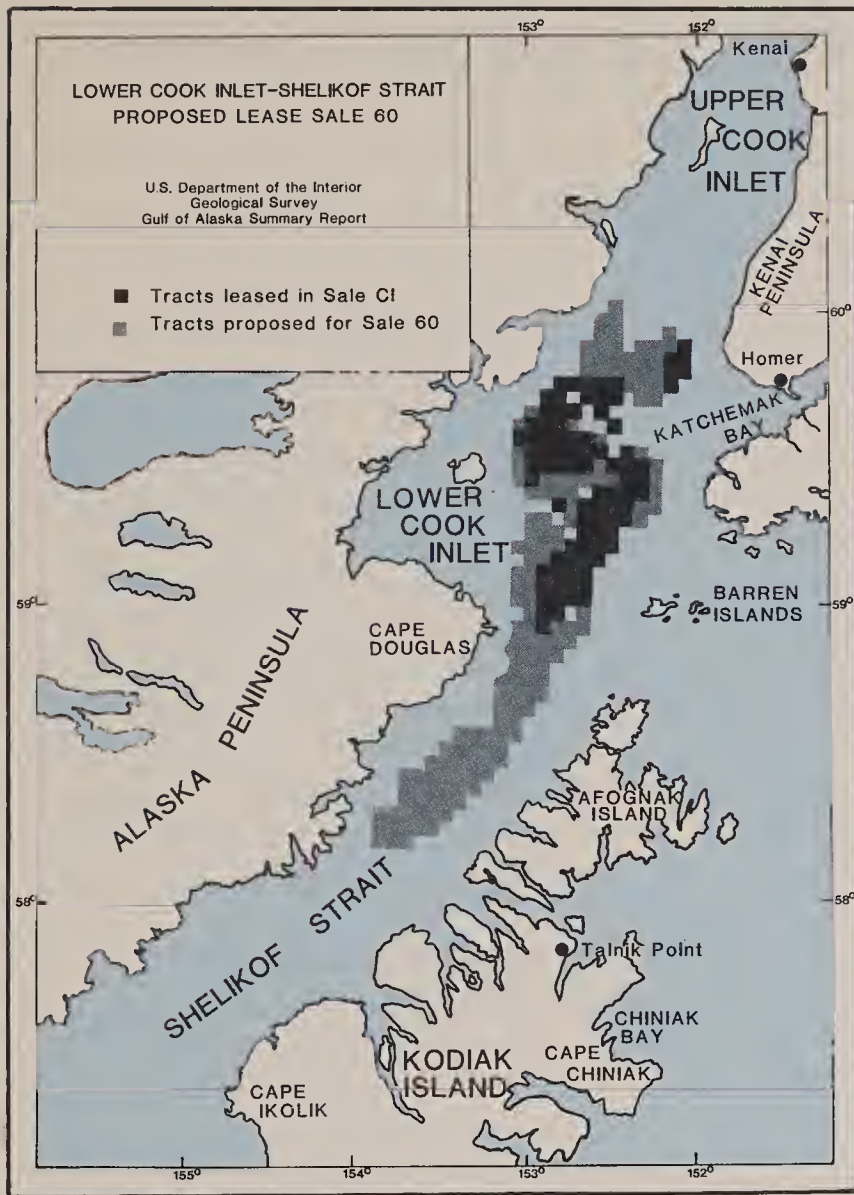


FIGURE 14.--Area proposed for Lease Sale 60 in Lower Cook Inlet - Shelikof Strait (adapted from BLM, 1980b by Rogers, Golden & Halpern).

North Sea, for example, 51 exploratory wells were drilled before a commercial discovery was made. Federal, State, and local officials have paid particularly close attention to OCS-related events in Alaska. The experience they have gained from Sales 39 and CI will result in increased understanding of the three lease sales currently planned for the Gulf of Alaska subregion.

3. Oil and Gas Transportation Strategies

If commercially producible quantities of oil and gas are discovered on the Alaska OCS, they will have to be transported for processing, refining, and distribution. The process of planning for and constructing the necessary transportation facilities is complex and expensive. Because of the intricacy of this process, it is desirable to begin planning as early as possible, even before oil and gas lease sales take place. The Bureau of Land Management takes a lead role in transportation planning through its Intergovernmental Planning Program for OCS Oil and Gas Leasing, Transportation and Related Facilities (IPP).

The IPP was officially activated on September 20, 1979, when the private-sector appointments were made to the Regional Technical Working Group (RTWG) Committees. These working group committees are composed of Federal and State officials and representatives of industry and other special and private interests. The members of the Alaska RTWG Committee, as of July 1980, are listed in table 5 (p. 28).

The movement of oil and/or gas from the Outer Continental Shelf to processing points and to users is an important part of the overall RTWG planning function. The principal end product of this planning effort is a Regional Transportation Management Plan (RTMP). If commercially producible quantities of oil or natural gas are discovered in the Alaska leasing region, an RTMP will be developed. At a minimum, the RTMP will include the following information and recommendations:

- analysis and recommendations for discrete transportation corridors and alternatives, including all routes

Transportation Planning is only one element of the IPP in Alaska. Two other activities--the Oil and Gas Leasing Process, and the Environmental Studies Program--are combined with Transportation Planning to form a coordinated planning system for OCS activity. For an overview of the Oil and Gas Leasing Process and the Environmental Studies Program, see appendix C, Intergovernmental Planning Program of the Bureau of Land Management.

to onshore facilities or to offshore terminals serving as collection points for more than one production area;

- identification of environmentally sound alternative areas for the location of onshore facilities;
- alternatives regarding surface vessel transportation, in accordance with appropriate regulatory agencies;
- plans for monitoring of construction and operations and any required follow-up studies; and
- any stipulations and use restrictions identified as applicable to transportation rights-of-way.

No RTMP's have been completed for the Alaska leasing region. Preliminary planning for criteria for pipeline corridor siting is under way. A detailed methodology to be used in planning pipeline corridors is being prepared under contract for the Washington office of the BLM and will be released during the summer of 1981.

TABLE 5.—Alaska Regional Technical Working Group Committee

Member	Affiliation
Mr. Gerald Reid	U.S. Fish and Wildlife Service
Mr. Rod Smith	U.S. Geological Survey
Capt. Harold E. Stanley	U.S. Coast Guard
(currently vacant)	U.S. Environmental Protection Agency
Mr. Fred Thorsteinson	National Oceanic & Atmospheric Administration, National Marine Fisheries Service
Ms. Esther Wunnicke	BLM Alaska OCS Office
Mr. Dennis Dooley	State/Federal Transportation Planning Organization
(currently vacant)	State of Alaska
The Hon. Alan Beardsley	Mayor, City of Kodiak
Ms. Judith Anderegg	League of Women Voters
Mr. Dave Benton	Friends of the Earth
Mr. Geron Bruce	United Fishermen of Alaska
Ms. Kay Diebels	Private Citizen
(currently vacant)	Industry
Mr. Caleb Pungowiyi	Kawerak, Inc.

For further information concerning the Alaska Regional Technical Working Group Committee membership, contact Gordy Euler, Bureau of Land Management, 620 East 10th Avenue, P.O. Box 1159, Anchorage, AK 99510 (telephone: (907) 276-2955).

Although a number of transportation corridors have been established in the Upper Cook Inlet as a result of offshore production in State waters, it is unlikely that these pipeline corridors will be used if a commercial discovery of oil or gas is made in Lower Cook Inlet.

A number of studies have been conducted in this Alaska leasing region that may aid in transportation planning. More information on these Federal, State, and local OCS-related studies for the Gulf of Alaska subregion is presented in appendix D.

4. Nature and Location of Nearshore and Onshore Facilities

The onshore effects of OCS activity in the Gulf of Alaska subregion to date have been associated with support bases for exploratory drilling resulting from Lease Sales 39 and CI. The onshore activity resulting from Lease Sale 39 was concentrated in Yakutat and Seward. Kenai, Homer, and to a lesser extent Seward provided onshore support for Lease Sale CI. The general nature of support activity for exploratory drilling in the Gulf of Alaska is discussed in the first section of this chapter. Information concerning affected communities in each lease sale area follows.

Onshore support bases, or service bases, are the staging areas for offshore oil and gas activity. They provide materials and services needed to maintain the offshore operations. Generally, materials are delivered to the support base by barge, rail, or plane and are stored until supply boats or helicopters transfer them to the offshore operations.

The search for support bases for exploratory drilling may begin before a lease sale is held. This was the case in the Gulf of Alaska. In 1974, 3 years prior to Lease Sale 39 and prior to the publication of an OCS oil and gas leasing schedule, a Shell-Atlantic Richfield Company-Mobil consortium (SAM) bought 6 hectares (15 acres) of waterfront property in Yakutat and a 1-hectare (2-1/2-acre) site across Monti Bay. Exxon secured a site in Seward soon after the sale was held.

Most support bases for exploratory drilling include berths for supply boats, dock space for loading and unloading, warehousing and open storage areas, a helipad, and space to house supervisory and communications personnel. Ideally, a support base is located as close

to the offshore drilling as possible. However, support facilities need not be concentrated in one location, and their locations may not be determined solely on the basis of proximity to exploration sites. The attitudes of local communities toward growth and oil- and gas-related activities, as well as the existing infrastructure, play a major role in the siting of support facilities.

The locations of support facilities in the Gulf of Alaska subregion illustrate these points. For example, Yakutat's attitude toward growth shaped the type and location of support facilities for Lease Sale 39 (p. 30). Offshore exploration, development, and production of oil and gas in the State-owned waters of Cook Inlet resulted in the establishment of support facilities at Kenai. This existing infrastructure, as well as Kenai's experience with offshore activity, played a major role in the siting of most support facilities for Lease Sale CI in Kenai (p. 34).

A sheltered harbor is preferred for a support base, and the base should have a water depth of at least 5.5 m (18 ft) at mean low tide to accommodate supply boats. Although support bases for exploration may be as small as 2 hectares (5 acres), they are generally larger. The size of the base is determined in part by the number of drilling vessels it must support simultaneously.

Drilling vessels are generally not owned by the oil companies for which they drill; they are leased. Lease rates for drilling vessels are determined by the type of vessel, its size, and its age. Lease cost estimates for drilling vessels used in the Gulf of Alaska subregion ranged from \$30,000 to \$50,000 per day for

the vessel and crew (Northern Resource Management, 1980).

Personnel on drilling vessels include rig personnel, drill operator personnel, and sub-contractors, typically numbering 40 persons per rig. The shift arrangements on the vessels necessitate a total crew of about 80. Crews on most of the rigs that operated in the Northern Gulf of Alaska and Lower Cook Inlet worked on/off shifts of 21 or 28 days. These are longer shifts than usual on drilling rigs: in other parts of the United States, a rotating on/off shift of 14 days is normal. The longer shift was instituted in Alaska due to the high cost of transporting trained workers to their homes in other States. In frontier areas, entry-level personnel are usually hired locally, in part to gain local goodwill and also to reduce travel costs.

The oil company leasing a drilling rig is responsible for providing transportation for the rig's crew, so it is the oil company that arranges for helicopters to ferry these personnel to and from the rig. Two to three helicopter trips are usually made to a drilling vessel each week.

The oil company also leases the supply boats used to service the drilling vessels. These boats carry large quantities of supplies and equipment to the drilling vessels: drill pipe, drilling mud, cement, food, fuel, water, casing, hardware, and other equipment. At least two supply boats are needed to service each rig. One boat stands by the rig at all times to evacuate the rig in case of fire or other accident (Knowles, 1980, oral commun.). The boats are loaded at the support base once every 2 or 3 days, carry the supplies to the rig, and return with waste material. The boats used in the Northern Gulf of Alaska and Lower Cook Inlet were 49 to 67 m (160 to 220 ft) long and approximately 12 m (40 ft) wide, drawing 3.5 to 5 m (12 to 17 ft) when loaded. They consumed between 2,400 and 8,000 gallons of fuel per day. Lease costs were on the order of \$5,000 per day excluding fuel (Northern Resource Management, 1980).

LEASE SALE 39

Two small communities--Yakutat and Seward--were affected by the exploratory activities resulting from Lease Sale 39. Yakutat did not welcome the opportunity to serve as a support base for OCS activity. But the town and the native corporation worked closely with the State and several oil companies to shape the development in a manner acceptable to the local people. Yakutat's experience can be useful to other small communities, especially those that feel threatened by the impacts that may result from offshore petroleum activity.

On the other hand, Seward looked forward to its role as a support base. The residents of Seward seem somewhat disappointed that the positive economic impacts were not as great as anticipated (Johnson, 1980, oral commun.).

Anchorage was also minimally affected by Lease Sale 39. All nonlocal people working on Lease Sale 39 activities flew in and out of Anchorage on their trips between the drilling rigs and home. Although it is impossible to estimate the effects this had on the economy of Anchorage, it seems reasonable to assume that hotels, restaurants, and the like had a temporary increase in business.

Yakutat

Yakutat (fig. 15) is located on the Gulf of Alaska at Yakutat Bay, which is the only natural deepwater harbor on the Gulf of Alaska between Cordova and Cape Spencer. Located approximately 113 km (70 mi) northeast of the sale area, Yakutat was originally settled by a diverse group of Indian people who eventually came to share a distinctive Tlingit culture. The community has experienced the effects of early exploration, Russian fur trading, and severe epidemics. During World War II, several thousand American troops were



FIGURE 15.--Yakutat and Monti Bay (adapted from Alaska Consultants, Inc., 1976 by Rogers, Golden & Halpern, 1980).

quartered there. Notwithstanding these contacts, the traditional culture of the community has been retained and is highly valued by its residents. Yakutat currently has a population of 600, about 75 percent of whom are Tlingit Indians.

Like many other Alaskan coastal communities, Yakutat relies on government and commercial fishing as its principal sources of employment. Data for 1978 show a labor force of 241 people. Of these, 82 were employed by Federal, State, and local governments, 38 were engaged in commercial fishing, and another 32 were employed in fish processing. Most of the remainder were involved in trade or manufacturing. However, it must be recognized that fishing is a traditional and communal activity as well as an economic enterprise: the actual number of people involved in fishing may be much greater than the numbers above indicate. The isolation of the area--glaciers and ice-fields on three sides, and the Gulf of Alaska on the fourth--and the Tlingit culture have produced not only a great dependence on fishing, but a distinctive style of fishing as well. Unlike fishing in other areas of Alaska, fishing in Yakutat is

performed near shore by a fleet of small vessels manned, almost exclusively, by local residents.

A survey conducted in Yakutat in 1975 indicated that both native and non-native residents wanted the basic elements of the traditional culture of Yakutat maintained (Alaska Consultants, Inc., 1975). The values held most strongly by the residents included social and economic interactions of the small community, good hunting and fishing opportunities, and the beautiful natural surroundings. Because of the importance of these values, the community has a very conservative attitude toward growth and development. Sentiments are somewhat divided between those who favor no development and no growth and those who favor limited, controlled development and growth. However, virtually none of the residents favor large-scale development or growth beyond a population of 1,500 (Alaska Consultants, Inc., 1975).

Given these values, it is not surprising that the people of Yakutat greeted OCS development off their shores with a great deal of trepidation. They viewed the use of their town as a support facility as a sure way to quickly increase the population of the town, to intensify competition for fish and game, and to destroy the beauty of the area. Because of these sentiments, they fought to hold all impacts to their community from Lease Sale 39 to an absolute minimum.

The SAM consortium approached the town in 1974 about rebuilding the Ocean Cape cannery dock and developing another dock, which SAM had bought a few months earlier, as a support base in the center of town (fig. 15). This was not acceptable to the people of Yakutat and they retained Alaska Consultants, Inc., to revise their 3-year-old land use plan. As a result of this revision, they did not approve industrial use of the 6 hectares (15 acres) SAM owned in the town.

During this period there was also considerable activity on the 1-hectare (2-1/2-acre) parcel that SAM had obtained south of

Yakutat, across Monti Bay, as a temporary dock and storage facility. The land and the improvements were reputed to have cost \$3.5 million, which was 3-1/2 times the assessed value of all the real property in Yakutat (Gillman, 1977). At this point, the city and Yak-Tat Kwaan, Inc. (the native village corporation) began intense negotiations with the State and the consortium.

The 1-hectare Monti Bay site was acceptable to the townspeople as a support base. However, this parcel was too small to accommodate all support facilities needed, and the adjacent land was owned by the State of Alaska. Following negotiations, the State exchanged 26 hectares (65 acres) of State land for a parcel of equal value owned by Yak-Tat Kwaan. The city and the native corporation then set about controlling the type of development and the impacts to Yakutat through leasing arrangements with the oil companies and arranged to buy the 7 hectares (17-1/2 acres) of land originally purchased by SAM. Eventually, Mobil withdrew from the negotiations and Atlantic Richfield Company and Shell signed a lease with Yak-Tat Kwaan for operation of a 31-hectare (77-acre) service base and industrial park. The idea was to confine all OCS-related activity, including quarters for oil company and drilling vessel employees, to this compound. The lease obligates the oil companies to hire locally where possible and to keep the number of new families moving to the Yakutat area to an absolute minimum. Atlantic Richfield Company and Shell are responsible for any necessary capital improvements on the property. These improvements, including the buildings, will become the property of Yak-Tat Kwaan when the 3- to 20-year lease expires.

Atlantic Richfield Company and Shell constructed a finger pier 35 m (115 ft) long and 7.3 m (24 ft) wide to support the two semisubmersible rigs--the Sedco 706 and the Ocean Ranger--that drilled for them. At its peak of activity, about 30 people were employed at the marine service base, almost all of them local residents.

Yak-Tat Kwaan leased another parcel of

161.9 hectares (400 acres) adjacent to the service base supply dock to the Pacific Alaska LNG Company. This firm planned to use about 30 percent of the site for an LNG plant, if gas were discovered in commercially recoverable quantities offshore, and if the company bid successfully for the gas. However, interest in the LNG project has dwindled with the decreasing hopes of a commercial discovery of gas on the land leased in Sale 39.

The Yakutat airport, about 8 km (5 miles) southeast of the town, was the center for helicopter operations serving all the drilling vessels operating in the Gulf of Alaska as a result of Lease Sale 39. As many as 20 people were associated with the operations of ERA Helicopters and Evergreen Helicopter of Alaska at the height of the exploration activity. Almost all these people were from outside the Yakutat area, but even during the support operations they did not live in the community.

In 1979, a movie was made for public television documenting the reaction of the people of Yakutat to Lease Sale 39. The fears voiced in the film--that a vast increase in population and the destruction of the present life style would accompany OCS activities--have not been realized. This was due in part to the manner in which Yakutat controlled the activities resulting from exploration and in part to the fact that no commercial discoveries were made.

Most of the people employed on the drilling vessels never entered Yakutat. They traveled to and from Yakutat on fixed-wing aircraft and went from the airport to the rig on helicopters.

As they begin to prepare for Lease Sale 55, the people of Yakutat are considering adopting a less exclusionary policy toward OCS activity and the people associated with it. Yakutat intends to improve the Ocean Cape Cannery Dock through either CEIP assistance or a special grant from the legislature. Part of the improvements would equip the dock to serve as a support base for OCS activity (Kohler, 1980, oral commun.).

Seward

Seward (fig. 16) is located on Resurrection Bay, 209 km (130 mi) south of Anchorage and about 451 km (280 mi) by air west of the Sale 39 area. A preliminary U.S. Census report in 1978 indicated that Seward had a population of 1,778. Incorporated in 1912, Seward was for years a major port of entry to other parts of Alaska. Its commerce was built around commercial shipping and railroad transportation. By the early 1960's, more than 600,000 short tons of cargo were passing

through its harbor each year. Seward also had a flourishing commercial fishery.

The 1964 Good Friday Earthquake completely destroyed Seward's port and fishery. Although the port was eventually rebuilt, most of the shipping industry never returned. In 1977, Seward enlarged the city by annexing the Fourth of July Creek area directly across Resurrection Bay (fig. 17), hoping that its access to deep water would promote the development of an industrial park. The city applied for and received Coastal Energy Impact Program (CEIP) grants for a feasibility study (Arctic Environmental Engineers, 1978) and a plan for a marine industrial center at



FIGURE 16.--Seward (photograph by Maurice Lynch, USGS Conservation Division, Anchorage, Alaska).

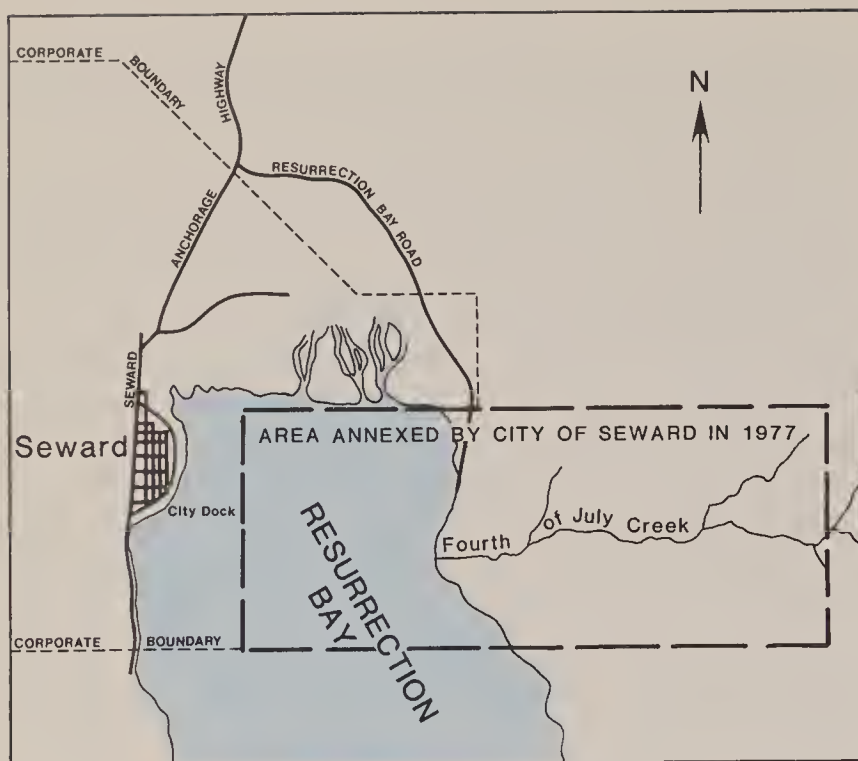


FIGURE 17.--Seward and the annexed Fourth of July Creek area (adapted from Alaska Department of Community and Regional Affairs, Division of Community Planning, 1979 and USGS, 1975 by Rogers, Golden & Halpern, 1980).

Fourth of July Creek (VECO, Inc., 1980), and in June 1979, an announcement was made by a consortium of Danish and Alaska firms that a \$16.2 million shipyard facility would be developed there (VECO, Inc., 1980).

Seward felt the first effects of OCS activity in 1975 when Dresser Industries, a drilling supply company, leased property from the city in anticipation of the need for an onshore support facility following Sale 39. Although Dresser did supply vessel operators, the company has not yet constructed any facilities. Exxon secured a site for its support base in Seward shortly after the lease sale was held. Texaco decided to use its existing sales distribution center in Seward as a base for its exploratory operations. In addition, Atlantic Richfield Company arranged for a storage area at the Seward Ferry Dock to supplement its storage facilities in Yakutat.

As well as providing support bases for three drilling vessels, Seward provided water for all five vessels that operated in the Northern Gulf of Alaska. Water used aboard the

Ocean Ranger averaged approximately 35,000 gallons per day. Much of this water was used in combination with drilling muds. The bulk of it was delivered from Seward via a supply boat, but some water was desalinated on board the rig.

Johnny Johnson, the City Manager of Seward, estimates that the support facilities located in that city provided jobs for about 40 people, about two-thirds of whom were hired locally (1980, oral commun.). No new building occurred in Seward as a result of Lease Sale 39.

Seward may have experienced the greatest impacts from Lease Sale 39 prior to the sale itself. Interest in the sale was very high, and this interest led to considerable land speculation. Land prices quadrupled just prior to the sale (Johnson, 1980, oral commun.). Although no commercial discoveries were made, the price of land did not return to its earlier level; in fact, it continues to increase. The other lasting impact of Lease Sales 39 on Seward is the town's increased awareness of the type of support needed for OCS activity. As mentioned earlier, Seward has been searching for a way to regain a strong economy since the 1964 earthquake. If it is built, the proposed Seward marine industrial center will provide year-round stable employment and stimulate local industry. It will also be able to serve as an outstanding support base for any future OCS activity in the Gulf of Alaska or Lower Cook Inlet and will be able to provide repair service for rigs and supply boats (Veco, Inc., 1980). Kenai Peninsula Borough has commissioned a study, Growth Management Strategy: Summary Report for Seward Region, from Simpon, Usher & Jones to report the effects of anticipated OCS-related development on Seward.

LEASE SALE CI

Almost all onshore impacts resulting from Lease Sale CI occurred on the Kenai Peninsula (fig. 18). There were two major support bases for exploratory OCS drilling:



FIGURE 18.----Kenai Peninsula (adapted from USGS, 1973 by Rogers, Golden & Halpern, 1980).

Kenai and Homer. Other areas affected minimally were Anchorage, Seward, and Seldovia.

If existing infrastructure were not an important factor in the siting of support facilities for OCS activity, it is likely that Homer would have played a more active support role than it did or that a site on the western shore of Cook Inlet would have been selected. However, there are no population centers and virtually no infrastructure on the western coast of Cook Inlet (fig. 19). The city of Kenai had established itself as a support base for exploration, development, and production in State waters: there are approximately 50 oil- and gas-related companies in Kenai and Nikiski (a small community about 16 km (10 mi) north of Kenai). Therefore, almost all the infrastructure and supplies needed for OCS exploration could be found in the Kenai area.

A sign at the airport identifies Kenai as "The Oil Industry Capital of Alaska." Many

Leasing of offshore State lands in Upper Cook Inlet began in 1959. Nineteen competitive oil and gas lease sales have been held since that time, which have leased a cumulative total of 768,920 hectares (1.9 million acres). There are currently 14 production platforms operating as a result of these sales. The next State lease sale in Cook Inlet is scheduled for December 2, 1980.

Kenai residents are originally from the Gulf of Mexico region and have moved to Alaska as a result of their oil- and gas-related skills. OCS activity was thus neither as threatening nor as undesirable to them as to others who had had no first-hand experience of it. By contrast, the activity resulting from Lease Sale CI was Homer's first experience with petroleum activity, and its residents were somewhat mixed in their reactions.

The Kenai Peninsula has some of the oldest non-native settlements in Alaska. The names of the towns give evidence of their former Russian occupancy: in addition to Kenai and Nikiski, there are also Kasilof, Kalifonsky, Soldotna, and Ninilchik. The Peninsula is noted for its beauty and is enjoyed as a recreation area. Some of the best weather in Alaska can be found there, and the residents claim that their winters are less severe than Chicago's. Because of the charms of the Peninsula, the availability of air transportation, and the fact that many of Alaska's residents are employed in industries which schedule work in 14- or 21-day on/off shifts, many Alaskans make their homes there although they work in distant parts of the State. As a result, the population has increased 182 percent since 1960 (Kenai Peninsula Borough, 1980). Most residents have become accustomed to the fact that the population of the Peninsula will grow fairly rapidly, although there are differing views concerning the ideal pace of the growth.

Kenai

Kenai is located 161 km by air (100 mi) north of the sale area and has a population of



FIGURE 19.--Undeveloped western shore of Cook Inlet between Shaw Island and Cape Douglas (photograph by Maurice Lynch, USGS Conservation Division, Anchorage, Alaska).

approximately 4,500. This includes the population of North Kenai and the industrial area of Nikiski (fig. 20). It is the third oldest port on the west coast of the United States.

Because Kenai is an established support base for offshore oil and gas activity, it is difficult to ascertain exactly what impacts were caused by Lease Sale CI. Vincent O'Reilly, mayor of Kenai, maintains that activity on Federal offshore leases was not even noticed by residents. This was due to the small scale of operations. Mayor O'Reilly points out that during the mid-and late-1960's, when the town had a permanent population of 600, there were several thousand construction workers in Kenai. Currently at least 20 percent of the population is estimated to be

involved in the oil industry in some way (O'Reilly, 1980, oral commun.).

Supply boats for all rigs used the Nikiski Rig Tender's dock, approximately 16 km (10 mi) north of Kenai, as well as the Homer City Dock, with the Nikiski dock getting about 60 percent of the total dockings. The supply boats are estimated to have spent about \$200,000, including dockage, wharfage, water, and storage charges at the Nikiski dock.

Fuel for drilling vessels, supply boats, and helicopters, drilling mud, and cement were purchased locally. The jet fuel for helicopters was trucked to Homer. Water was purchased locally at a rate of \$300 per month (Northern Resource Management, 1980).



FIGURE 20.—Onshore facilities, Rig Tender's Dock, and pipelines at Nikiski (photograph by Maurice Lynch, USGS, Conservation Division, Anchorage, Alaska).

Because the existing facilities were adequate, no new building occurred in Kenai as a result of the lease sale. Companies that already had facilities in the area used them. For example, Phillips Petroleum used office space at its Nikiski plant as OCS operations headquarters, and Atlantic Richfield Company used its existing warehouse. Most onshore jobs created by exploratory drilling were filled by experienced local people. Land prices in Kenai do not seem to have suffered from pre-sale speculation, as was the case in Yakutat, Seward, and Homer.

A survey was conducted by the USGS and the Kenai Peninsula Borough in July 1980 in order to determine how many of the existing oil support companies currently located in Kenai would be interested in expanding their

business if a commercial OCS discovery of oil or gas were made in Cook Inlet. Although the number of responses provided only a small sample, many companies indicated that they are currently operating at 50 to 80 percent of capacity. Almost all companies indicated that they would be interested in expanding their current operations. Most companies indicated that they would consider establishing a similar operation in another location if a discovery were made in a region that could not be adequately serviced by the Kenai operation (Jackson and McIlhargey, 1980).

Most residents of Kenai do not seem to have negative feelings concerning OCS development or the impacts from exploratory drilling. Almost all residents were disappointed that a commercial discovery was not made as

a result of Sale CI. Even local fishermen, the group that seemed most likely to oppose OCS activity, did not appear to wish to prevent exploration; their only negotiations with the oil companies were to protect their fishing gear.

Homer

Homer served as a secondary support and crew transport base during the exploratory drilling resulting from the Lower Cook Inlet lease sale. It has a population of almost 3,000.

Homer is located on Kachemak Bay, about 72 km (45 mi) east of the sale area. The Bay is known internationally for its diversity of commercial fish species, which include five kinds of salmon as well as halibut, herring, and large quantities of shellfish, including crab, shrimp, prawns, clams, mussels, and scallops. An average of 5 to 6 million pounds of shrimp per year have been harvested from the Bay for the last decade.

Like Yakutat and Seward, Homer experienced considerable pre-lease sale land speculation. It is estimated that the price of land has increased about 180 percent during the last 4 years (Farnan, 1980, oral commun.). However, it is difficult to say how much of the increase was due to anticipated OCS activity and how much was due to the general growth of population in the Kenai Peninsula.

After the Sale CI was held, two areas in Homer were affected--the dock and the airport. As mentioned in the discussion of Kenai, supply boats servicing the Lower Cook Inlet drilling vessels did not work exclusively from one dock: about 40 percent of the time, they docked at Homer. The dock in Homer is owned by the city, which collected approximately \$35,000 in dockage fees, \$6,000 for wharfage fees, and \$17,000 for water during the 11 months that exploratory rigs were operating on the Lower Cook Inlet OCS.

Homer's airport was used as a helicopter base for all drilling vessels. The only building to occur in Homer as a result of OCS activity

occurred at the airport. Two new hangars were built and leased to Atlantic Richfield Company and Air Logistics.

Prior to the sale, the community of Homer was divided concerning the advantages of serving as an OCS support base. About 50 percent of the residents favored the development and 50 percent opposed it. There are a number of commercial fishermen who reside in Homer, and their opposition became more vocal after an OCS drilling rig, being towed to Homer for repairs, caused the loss of fishing gear (Farnan, 1980, oral commun.). The extent of the damage is unknown, but opposition subsided after traffic lanes were agreed upon by both fishermen and drilling vessel operators.

Opposition to OCS-related activity seems to have decreased since the sale. Homer has learned that impacts from exploration have been negligible. The city has also prepared for future OCS activity by applying for CEIP grants that will help to minimize any impacts that may occur in the future. In FY 1977, CEIP funds helped finance a development plan, a roads and streets plan, a water system design, and a campground relocation plan and design. The latter project was necessary because future OCS development may dictate that portions of Homer Spit (the sand spit just south of Homer) be used for a support base, thereby necessitating the relocation of the camp grounds there. The City of Homer and Kenai Peninsula Borough are also preparing a special coastal management plan in order to assure the compatibility of maritime commerce and development activity with the biological productivity of Kachemak Bay.

Other areas

Seward was used for sporadic support for Lease Sale CI and a dock in Seldovia was used by one boat that conducted the biological and geohazard surveys required prior to drilling.

As with Lease Sale 39, Sale CI probably caused increases in Anchorage's hotel and restaurant business from drilling rig and supply

boat personnel who spent time in the city awaiting flights.

There may have been small increases in the private-sector labor force in Anchorage due to Lease Sale CI. Some oil companies, already having offices in the city, made small increases in their staffs.

CONCLUSION

Locally, the exploratory efforts in Alaska resulting from the two lease sales held in the Gulf of Alaska subregion have gone smoothly. The existing infrastructure was capable of meeting the demands placed upon it. The greatest impacts seem to have occurred prior to the sales, when considerable confusion existed concerning the anticipated effects. This confusion resulted in land speculation in the communities of Homer and Seward on the Kenai Peninsula and Yakutat in the Gulf of Alaska. Analysis to date has not determined how much of the increase in land costs was due to OCS activity and how much was the result of higher demand for housing generally.

Many of the commodities and services needed for OCS exploratory activity must be imported from other areas. Therefore, purchases were not typically made in the small communities affected by OCS operations.

Oil companies seem to have made an effort to hire local people to the greatest extent possible. However, many of the skills required by exploratory activity for oil and gas require considerable training and experience. In a report written for the BLM, Northern Resource Management (1980) estimated an exploration effort of 5,390 person-months for the period between October 1977 and January 1980. In terms of this total effort, Anchorage accounted for 16 percent, Kenai for 4 percent, Homer for 2 percent, the rest of Alaska for 3 percent, and other areas for 75 percent. Although Alaska labor accounted for 25 percent of the total effort in terms of time, Alaska

residents made up 33 percent (180 people) of the total number of people employed.

It seems that the most noteworthy result of exploratory OCS activity in the Gulf of Alaska subregion has been that of OCS education. Communities have learned what impacts can be expected from exploratory drilling on the OCS and how to prepare for impacts that may result from commercial discoveries in the future. State and Federal agencies have learned how to respond to local concerns and how to mitigate a variety of impacts. As the Gulf of Alaska subregion prepares for its next three scheduled lease sales, the benefits of this education should become apparent.

As in other frontier areas (Macpherson and Bookman, 1980, and Jackson, 1980), it seems that exploratory drilling has had few impacts on local communities. Knowledge of these minimal impacts may reduce land speculation in the future. The negative perceptions that often precede exploratory drilling seem to become modified when the community actually experiences OCS exploration.

On the Federal level, Department of the Interior procedures concerning pre-leasing activities have undergone modifications since the leasing of OCS lands began in Alaska. In 1975, the DOI instituted a consultation process, known as 2974 meetings (Secretarial Order no. 2974), that allows various agencies within the Department to obtain a consensus on specific lease stipulations and Notice to Lessee requirements for each lease sale. These meetings have been expanded to include agencies of other potentially affected departments.

As a result of the Council on Environmental Quality's regulations for implementing the procedural provisions of the National Environmental Policy Act (Federal Register, November 19, 1978). The BLM has instituted a scoping process: a series of public meetings to determine issues of concern, possible alternatives, and possible mitigating measures. These meetings are open to Federal and State agencies, special interest groups, and citizens. They are held for each lease sale after tract

selection and prior to the time that the BLM prepares a draft EIS. The concerns voiced in these meetings are incorporated into the EIS and are used to focus it. The first scoping meetings were held for Lease Sale 55: two meetings in Anchorage and two in Yakutat.

As a result of the litigation following Lease Sale CI, the USGS will be required to write a development-phase EIS after the first commercial discovery in Lower Cook Inlet, if such a discovery is made.

For additional help in planning for coastal effects associated with OCS oil and gas development, limited technical assistance is available. All requests for technical assistance will be evaluated and approved on a case-by-case basis, and inquiries should be directed to the OCSI office at the address shown in the front of this publication.

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Appendix A. The Geologic Setting

PETROLEUM GEOLOGY

Hydrocarbons are formed within the upper part of the earth's crust. Through the action of heat and pressure, accumulations of organic matter are transformed into various mixtures of crude oil and natural gas. The time between deposition of organic material and the formation of hydrocarbons is on the order of millions of years (Tissot and Welte, 1978, p. 198).

The occurrence of hydrocarbon accumulations depends on many factors (Miller and others, 1975, p. 17):

- an adequate thickness of sedimentary rocks;
- the presence of source beds (rocks containing large amounts of organic matter);
- a suitable environment for maturation of the organic matter into oil and/or gas;
- the presence of porous and permeable reservoir rocks;
- hydrodynamic conditions permitting the migration of hydrocarbons and their ultimate entrapment in reservoir rocks;
- the area's having a thermal history that favors production and preservation of hydrocarbons;
- formation of adequate geologic traps for accumulation of the hydrocarbons; and

- suitable timing of petroleum generation and migration to ensure the entrapment and preservation of the hydrocarbons.

In a prospective hydrocarbon province, geologists look for structural or stratigraphic traps, in which oil and gas can accumulate. Structural traps include anticlines, sediments draped over salt diapirs and other dome-like intrusions, and fault traps. Examples of stratigraphic traps are reefs and the edges of porous strata truncated by impermeable strata. Traps may also be formed by a combination of structural and stratigraphic elements.

THE NORTHERN GULF OF ALASKA OUTER CONTINENTAL SHELF

A major subsurface feature underlying the Northern Gulf of Alaska OCS is the Gulf of Alaska Tertiary subprovince. This subprovince is a basin 900 km (560 mi) long by 200 km (125 mi) wide. Approximately 52,000 sq km (20,000 sq mi) of the Gulf of Alaska Tertiary subprovince lie offshore, where the subprovince extends between Cross Sound and the Amatuli Trough. Petroleum seepages and petroliferous rocks occur onshore in the subprovince.

The Tertiary rocks are known from onshore outcrops, geophysical investigation, and oil and gas wells drilled along the coastal lowland of the Gulf of Alaska Tertiary subprovince (Plafker, 1971). Surface mapping of onshore areas has also been conducted since 1944 as part of the USGS's program of petroleum investigations in southern Alaska. More

recently, seismic data were collected for offshore areas by the USGS in anticipation of Lease Sale 39. The USGS obtained and evaluated 5,713 km (3,550 line miles) of data in 1974 and 3,219 km (2,000 line miles) of data in 1975. A Continental Offshore Stratigraphic Test (COST) well was drilled in 1975 prior to the lease sale, but it was abandoned at a depth of 1,555 m (5,100 ft) because of bad weather and drilling problems. After the lease sale, in 1977, an additional 1,287 km (800 line miles) of seismic data were acquired by the USGS. Also during 1977, sample bedrock outcrops along the Continental Slope were dredged and studied to aid in the evaluation of seismic data at the seaward margin of the Tertiary basin. Exploratory drilling on the OCS was conducted by the petroleum industry from September 1976 to July 1978; however, geologic information from wells on active leases is proprietary and is not included in this report.

The Gulf of Alaska Tertiary subprovince is a thick sequence of sediments with petroleum reservoir potential that were deposited during the Tertiary period, between 70 and 7 million years ago. These sedimentary rocks have an approximate aggregate thickness of at least 12,192 m (40,000 ft) in the basin. The rocks with the greater petroleum potential were deposited during the middle and late Tertiary periods and have an average thickness of 3,048 to 6,584 m (10,000 to 21,600 ft).

Figure 21 provides a cross section of the stratigraphic units of the Northern Gulf of Alaska OCS. The Tertiary rocks on the OCS are underlain by bedded rocks of Cretaceous and older periods. These older rocks are highly deformed and locally metamorphosed with no potential for producing petroleum (Plafker, 1971).

There are three major divisions of Tertiary rocks. The oldest Tertiary rocks are characteristically hard, dense, and intensely deformed, with negligible porosity. The middle Tertiary sequence consists of mudstone and siltstone strata that are locally richly organic. These are found in the central part of the Gulf of Alaska Tertiary province where oil and gas seeps occur onshore. Samples of middle Tertiary rocks dredged from the OCS

adjacent to the Yakutat Shelf have relatively high organic carbon contents, but the rocks are not sufficiently mature to have produced liquid hydrocarbons (Plafker and others, 1978). However, an untested area, where Lease Sale 55 will occur, may have middle Tertiary rocks buried deep enough to have generated petroleum. Upper (late) Tertiary rocks were deposited during cold-water conditions when shelf ice or glaciers were intermittently present. These sediments consist mainly of fossiliferous mudstone, sandstone, and glacial till, which have less petroleum reservoir potential than the middle Tertiary rocks. Most of the OCS is covered with unconsolidated deposits from the Quaternary period.

The structural configuration of the Gulf of Alaska Tertiary subprovince is mainly the result of interactions between the North American continent and the Pacific Ocean basin during the late Cenozoic time (Plafker, Bruns and Page, 1975). The central part of the province is a zone of compression and shear due to underthrusting of the continental margin. The availability of structural traps for petroleum accumulation and the geologic hazards in the province are direct results of this underthrusting.

The seismic data collected in the Gulf of Alaska indicate the presence of numerous structures with petroleum potential on the OCS. The larger, more continuous folds are concentrated on the Yakutat Shelf, where the Lease Sale 39 area is. The anticlines in this portion of the OCS are northeast-southwest trending structures, ranging from 4 to 10 km (2-1/2 to 6 mi) wide. Most of the known large structures were tested by at least one deep exploratory well. However, this exploratory drilling failed to encounter any commercial deposits of hydrocarbons within the structures. Dredge samples, together with industry's drilling record, indicate that the structures are young and have a negligible potential for petroleum (Plafker and others, 1978).

The major untested prospective area in the Northern Gulf of Alaska OCS is along the flanks of the Fairweather Ground structure on the Yakutat Shelf. This area is the location

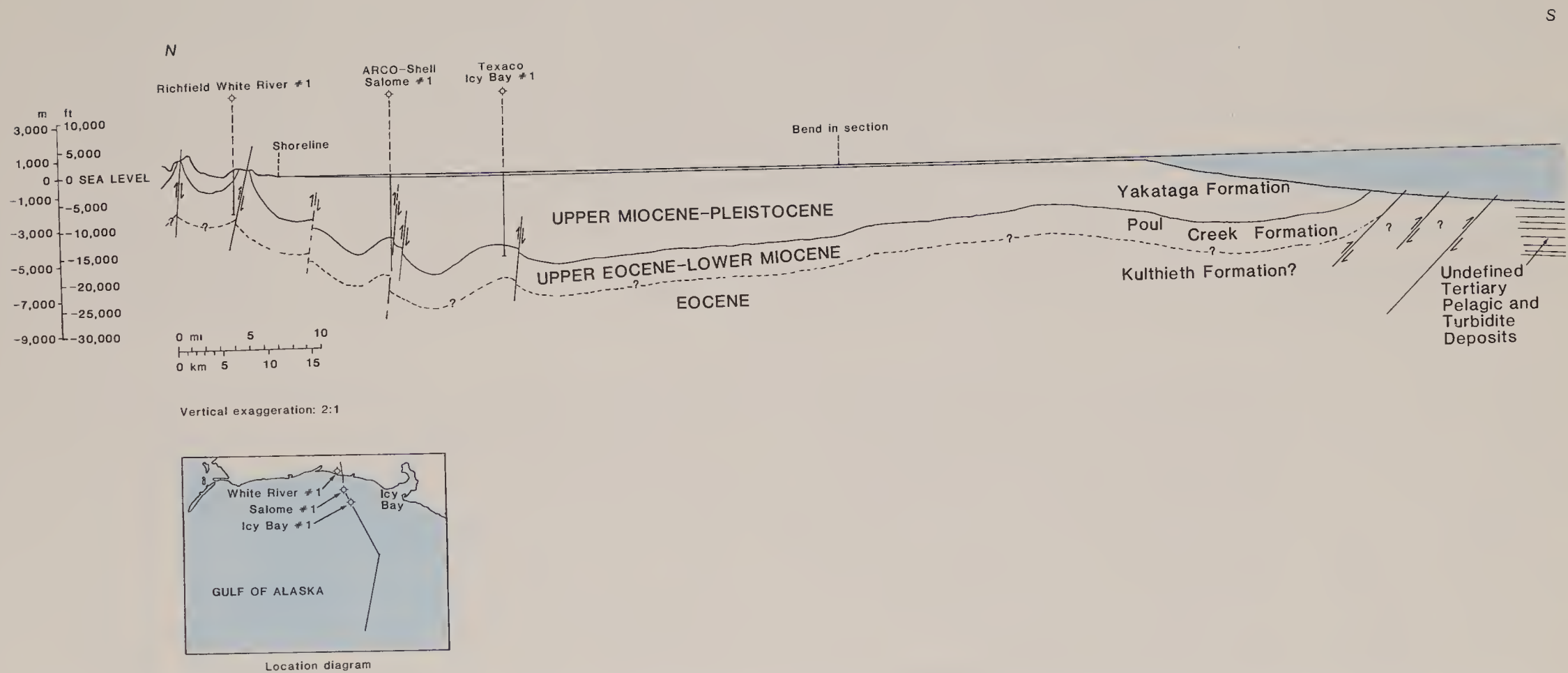


FIGURE 21.--Interpretive cross section of the Northern Gulf of Alaska (redrafted from Larson, 1980 by Rogers, Golden & Halpern, 1980).

for the upcoming Lease Sale 55. Both structural and stratigraphic traps may be present on this large feature, which could contain commercial quantities of hydrocarbons.

THE LOWER COOK INLET OUTER CONTINENTAL SHELF

The Lower Cook Inlet OCS is part of a belt of Mesozoic-Tertiary sedimentary rocks that extends northeast into Upper Cook Inlet and southwest down the Alaskan Peninsula and Shelikof Strait. Along this belt, the aggregate thickness of the Mesozoic rocks may be more than 12,000 m (39,370 ft), and the aggregate thickness of the Tertiary rocks may be as much as 7,600 m (25,000 ft). Four major northeast-trending geologic features flank Cook Inlet: the Aleutian Range Batholith and the Bruin Bay fault on the northwest side, and the Border Ranges fault and the undifferentiated Mesozoic terrain on the southeast side. The sedimentary rocks between these features contain proven petroleum reserves now producing oil and gas in Upper Cook Inlet.

The literature describing onshore geology dates from the turn of the century. The subsurface geology of Upper Cook Inlet and the Kenai lowland is generally known from exploratory and development wells in these areas. Seismic data from OCS areas in Lower Cook Inlet were first collected in 1975 prior to Lease Sale CI. Approximately 485 km (300 mi) of data were acquired and evaluated by the USGS. Also, two onshore areas (Cape Douglas and Seldovia) were mapped geologically for the purpose of extending the data offshore into the OCS lease sale area. A COST well was drilled in June 1977 to a depth of 3,776 m (12,387 ft) in 66 m (216 ft) of water in Lower Cook Inlet to provide stratigraphic information to the petroleum industry before the lease sale. After the sale was held on October 27, 1977, eight exploratory wells were drilled on the Lower Cook Inlet OCS. Geologic data collected by the oil companies during exploratory drilling are proprietary and are not included in the following discussion.

Figure 22 is a cross section of the Lower Cook Inlet OCS. Sedimentary rocks at least as old as the Triassic period (180 million years ago) are present in this area. The oldest sedimentary rocks of the Triassic period do not have petroleum potential. The next layer of rocks, of early Jurassic age, also does not have petroleum potential but is considered to provide a basement for rocks with petroleum reservoir potential.

Magoon and others (1976) have proposed the following explanation of the origin of oil in the Tertiary strata of Upper Cook Inlet: middle Jurassic rocks acted as the source for oil that may have been trapped in a large stratigraphic trap. Subsequent deformation caused the oil to migrate from the Jurassic rocks into Tertiary structural traps, from which it is now being produced.

In the Cook Inlet area, Tertiary rocks are commonly termed the Kenai Group and divided into the West Foreland Formation, Hemlock Conglomerate, and Tyonek, Beluga, and Sterling Formations. Approximately 80 percent of the oil produced in Upper Cook Inlet comes from the Hemlock conglomerate, and much of the remaining 20 percent of production is from the Tyonek Formation. Less than 2 percent of the production is from the West Foreland Formation, the oldest unit in the Tertiary sequence.

Well data indicate that the total Tertiary sequence is approximately 7,000 m (22,966 ft) thick north of Kenai in Upper Cook Inlet (Magoon and others, 1979). The sequence thins considerably toward Shelikof Strait; outcrop data obtained onshore in Lower Cook Inlet show that Tertiary rocks are approximately 1,850 m (6,070 ft) thick.

Producing oil fields in Upper Cook Inlet are located on the east and west flanks of the basin. All these fields are structural traps, either anticlines or faulted anticlines, and the oil reservoirs are sandstone and conglomerate rocks of Tertiary age. Similar northeast-trending structures are present on the Lower Cook Inlet OCS. However, exploratory drilling

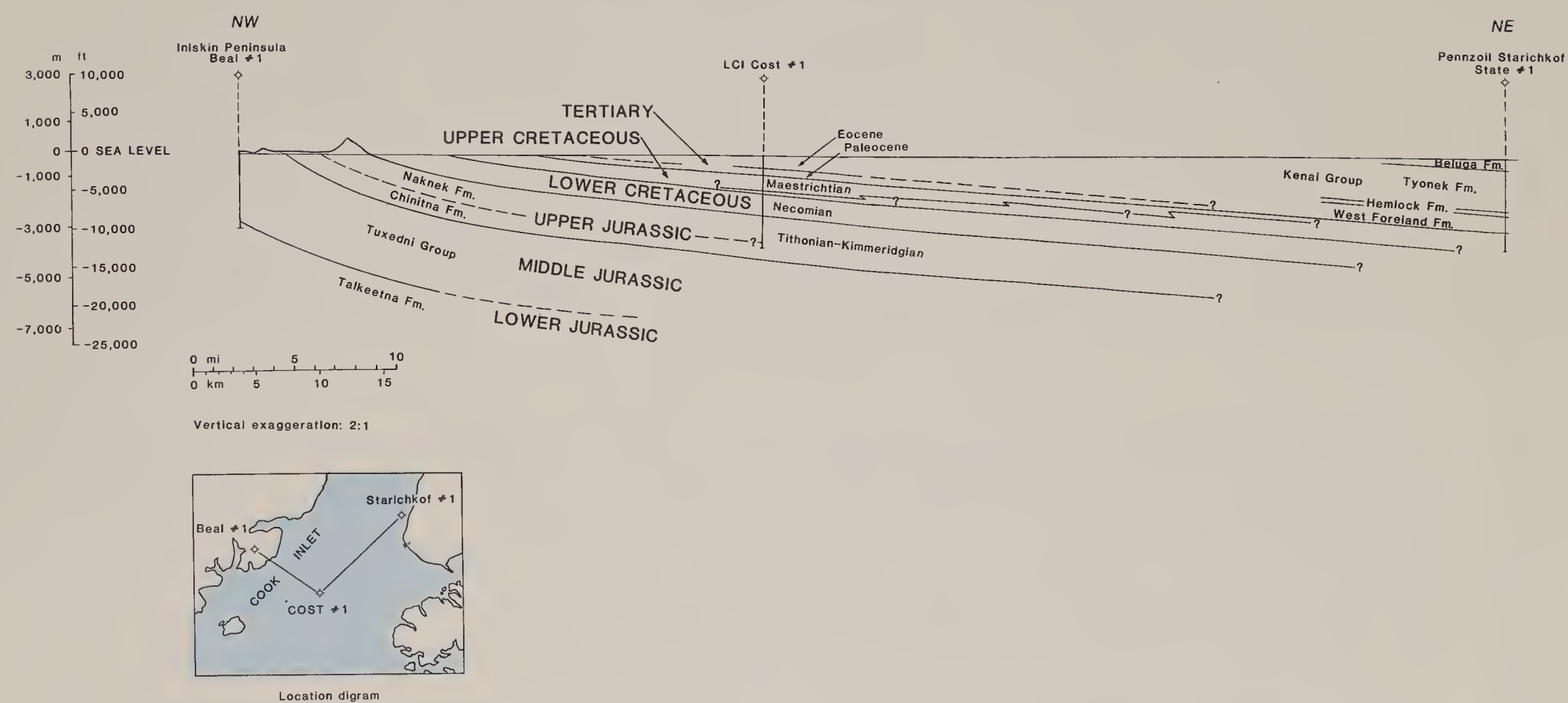


FIGURE 22.--Interpretive cross section of Lower Cook Inlet (redrafted from Wills and others, 1978 by Rogers, Golden & Halpern).

to date has not encountered commercial quantities of hydrocarbons trapped in these structures.

The major subsurface structural feature of Lower Cook Inlet is on an east-west trending transbasin arch called the Augustine-Seldovia Arch. This structure is much larger than the northeast-trending folds described above. Structural traps could be present either on the flanks of the Arch or where the northeast-trending anticlines intersect it. Since the entire Cook Inlet basin flexes around the Arch, oil could migrate either from the southern part of the basin or from known petroleum source rocks in Upper Cook Inlet. Exploratory drilling has been conducted in vicinity of the Arch, but commercial quantities of hydrocarbons have not been discovered there. However, not all potential structures on the Lower Cook Inlet OCS have been explored. Additional areas near the Augustine-Seldovia Arch and other promising structures on the Lower Cook Inlet OCS are proposed for lease in the upcoming Sale 60, scheduled for September 1981.

Appendix B. Estimating Hydrocarbon Resources and Reserves

Before exploratory drilling, both the Federal Government and industry undertake analyses of geological basins to determine their oil and gas potential. The Government uses a variety of methods of analysis depending on the purpose of the estimate and the availability and level of detail of the data. The data base for resource estimation is regularly updated with new geologic and geophysical information, and as more data for a given area are gathered, processed, analyzed, and interpreted, the resource estimate is updated to reflect them.

The process of estimating the amount of oil and gas in a potential reservoir or a lease sale area involves a high degree of uncertainty. The USGS makes pre-sale estimates for a variety of purposes. Regionwide estimates are used to aid in the preparation of proposed lease sale schedules. More specific resource estimates are made for the lands tentatively selected for leasing. Later estimates are made on a tract-by-tract basis to establish a minimum dollar value for each tract offered. However, it should be reemphasized that estimates of undiscovered resources are extremely uncertain. The existence of resources cannot be confirmed until an area has been thoroughly explored by drilling.

REGIONWIDE RESOURCE ESTIMATES

In the early stages of exploration, it is necessary to use expert judgment based on minimal amounts of data to make resource estimates. As more data become available, the resource estimates and the methods used are refined. When data are abundant and

detailed, the choice of method used depends on the availability of the estimator's time and the purpose of the resource estimate. The quality of the estimate, however, depends on the quality of the geological and geophysical data and other studies on which it is based.

A number of estimation techniques are available for making regionwide or basin resource estimates. For an area that has not been extensively drilled, the most useful group of techniques may be classified as the **volumetric yield methods**. In these methods, the volume of potentially hydrocarbon-producing rocks is calculated, and a yield of oil and/or gas based on known yields from geologically analogous basins or regions is derived. Other methods, more useful in regions that have experienced extensive exploratory drilling, are **performance** or **behavioristic extrapolation methods**. These methods fit various indexes of past performance, such as discovery rates, cumulative production, and productive capacity, by mathematical derivations into growth curves that are then projected into the future. In addition to these methods, more sophisticated methods involving geological, engineering and statistical models may be used (Miller and others, 1975, p. 18).

TRACT-SPECIFIC RESOURCE ESTIMATES

Each tract selected for leasing for exploration and development of oil and gas resources must be evaluated prior to the lease sale. After the lease sale, resource estimates for the lease sale area are periodically updated.

Resource evaluations of tracts consist of three parts: a geophysical and geological evaluation of potentially recoverable resources in possible hydrocarbon-bearing structures underlying the tract; an assessment of the risk that, for whatever reason, hydrocarbons are not present in the quantities foreseen by the geologic evaluation; and an engineering and economic evaluation of the monetary value of those resources, taking the assessed risk into account.

In developing resource estimates for frontier areas, the drilling and production histories of geologically analogous petroleum-producing basins and fields are initially used. Data used for more detailed resource estimation are seismic records, well data, other geologic data, and production histories from wells and fields in or near the sale area. Once an area has been leased and exploratory drilling has commenced, the results of drilling may allow updating of resource estimates. Changes in exploratory drilling and production techniques and costs may also necessitate re-evaluation.

The tract-specific resource estimates are derived by using a **Monte Carlo discounted cash flow computer program**. In this program, geologic, engineering, and economic information is used to calculate recoverable resources and an economic value of the resources for each tract. Some parameters, such as tract size, are entered as fixed values. Others, such as pay thickness and estimated recoverable resource volume per unit of reservoir volume, are given a range of values. Most variables are assigned a range of possible values. The program then randomly selects values for each variable and combines them with the fixed parameters to calculate a resource estimate, a production schedule, and an economic value. The program is run many times, and eventually a mean resource estimate and economic value are determined.

A **risk factor** is used to discount the mean resource estimate. The risk factor represents the probability that a particular trap will not contain hydrocarbons in the quantities predicted by the geologic evaluation. The risk factor is a subjective appraisal by a geologist, a geophysicist, and an engineer based on the

data available to them. It is determined through a knowledge of an area's (or an analogous area's) exploration history, together with an assessment of how strongly the data indicate the presence of a trap, of source rocks, and of other elements that make a good prospect.

RESERVE ESTIMATES

Reserves are the portion of identified resources that can be economically extracted (Miller and others, 1975, p.8). Before a reserve estimate can be made for a discovery, several wells must be drilled to delineate the volumes of oil and gas that have been discovered. Until a reserve estimate can be made, reserves are considered to be zero, even though resources may have been discovered. The techniques available for estimating reserves are similar to those used in making resource estimates, only in the case of reserves they are more refined and are based on more information.

In **volumetric estimation** of reserves, the bulk volume of a reservoir can be calculated from interpretation of seismic data and information gained by drilling. Porosity of the rock and the relative amounts of oil, gas, and water in its pore spaces can be interpreted from borehole logs and analyses of cores.

For reservoirs in which some production has taken place, the **decline-curve method** may also be used. In this method, future production is estimated by extrapolating plots of actual production rates and fluid percentages into the future. By adding past production to predicted future production, an estimate of original reserves can be obtained (Bird, 1980, p. 3-4).

Appendix C. Intergovernmental Planning Program of the Bureau of Land Management

The Intergovernmental Planning Program for OCS Oil and Gas Leasing, Transportation and Related Facilities (IPP) was implemented to provide a formal coordination and a long-range planning mechanism for three major national OCS program elements administered by the Bureau of Land Management (BLM). These interdependent elements are Pre-Lease Sale Activities, the Environmental Studies Program, and Transportation Planning. For ease of description in this Summary Report, each is treated as a separate component of the IPP planning process. Transportation Planning was discussed in chapter 3. The organization of the IPP and the other two elements--Pre-Lease Sale Activities and the Environmental Studies Program--are presented in this appendix. The appendix concludes with a discussion of the four phases of BLM's IPP program and of how the three elements of the OCS program and the four phases of the IPP are integrated for a given lease sale.

ORGANIZATION OF THE IPP

The Washington, D.C., component of the IPP is organizationally located within the BLM's Division of Offshore Resources. It was implemented to provide a formal coordination and long-range planning mechanism for the three major OCS leasing program elements. Regional IPP offices are located organizationally within the Office of the Manager.

The National OCS Advisory Board provides advice to the Secretary of the Interior and to other offices in the Department of the Interior in the performance of discretionary

functions of the OCS Lands Act as amended (43 U.S.C. 1331 et seq.), including all aspects of leasing, exploration, development, and production of the resources of the Outer Continental Shelf. The three committees of the National OCS Advisory Board and their responsibilities are as follows. The Policy Committee provides policy advice; the Scientific Committee provides scientific advice; and the RTWG Committees provide technical advice. The organization of the National OCS Advisory Board and its reporting structure are presented in figure 23.

In each of the six OCS leasing regions of the country, a Regional Technical Working Group (RTWG) Committee has been established. Through the accumulation and evaluation of information, the RTWG provides guidance to the BLM and information to other bureaus within the Department of the Interior. Each RTWG is composed of representatives of the participating States, the BLM, the Fish and Wildlife Service, the Coast Guard, the Geological Survey, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, the petroleum industry, and other special and private interests that exist in a leasing region. Every RTWG is co-chaired by a BLM employee and a State representative.

There have been six meetings of the Alaska RTWG Committee. Four of these meetings were held in Anchorage, one in Juneau, and one in Norfolk, Virginia.

The first meeting of the Alaska RTWG was held in Anchorage on November 6 and 7, 1979. At this meeting, the members of the Alaska RTWG were introduced to each other,

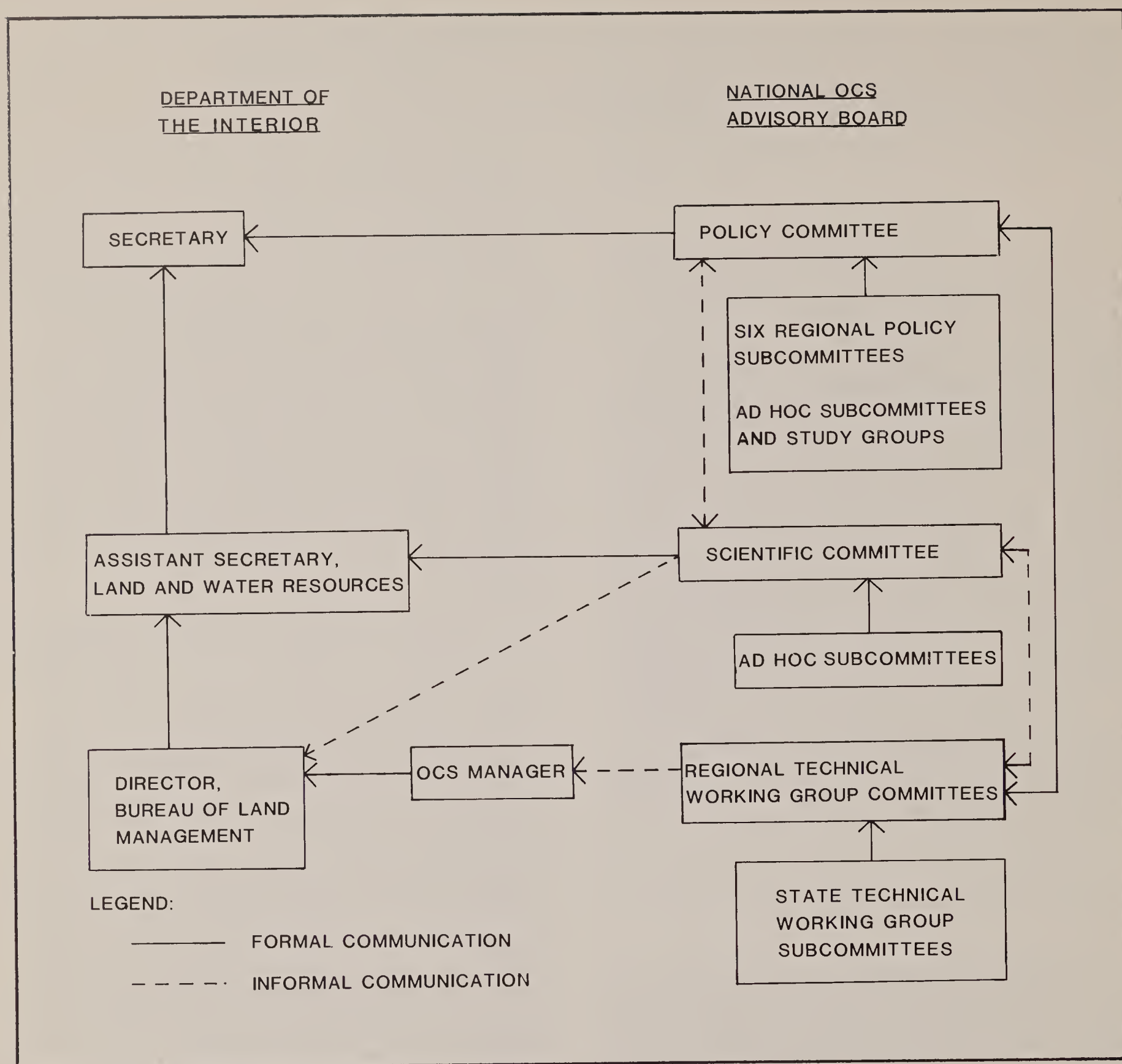


FIGURE 23.--Organization and reporting structure of the National OCS Advisory Board (adapted from Aronson, 1979 by Rogers, Golden & Halpern, 1980).

to the Intergovernmental Planning Program, and to the various aspects of the OCS leasing program.

Norfolk, Virginia, was the scene of the second meeting, held on December 6 and 7, 1979. This meeting was also the plenary

session of the National OCS Advisory Board. The Alaska OCS office presented environmental portrayals for proposed Lease Sales 57 (Norton Basin) and 70 (St. George Basin) and discussed issues relevant to the upcoming proposed Lease Sale 60 (Lower Cook Inlet-Shelikof Strait). These issues, which were reiter-

ated in the third (February 1980) meeting, included tourism and other recreational activities, competition between sport and commercial fishing, seismic hazards and subsea faults, and impacts on lifestyles, the economy, and recreational activities.

The third meeting was held in Anchorage, Alaska, on February 19 and 20, 1980. During this meeting, the Alaska RTWG identified issues for study in the environmental statement for proposed Sale 60. The group was also presented with information on the Environmental Studies Program, BLM's Pre-Lease Sale Activities, and the status of proposed Sales 57 and 70.

At the fourth meeting, held on April 2 and 3, 1980, in Anchorage, Alaska, the RTWG identified issues for discussion in Lease Sales 57 and 70 environmental statements, considered resolutions from the City Council of Nome and the Association of Village Council Presidents concerning Lease Sales 57 and 83 (Navarin Basin). For proposed Lease Sale 57, the issues identified included commercial herring fisheries, extreme storm conditions, meteorology, climate, the adequacy of available drilling technology, exploration restrictions, and test structures. For proposed Lease Sale 70, issues raised included geohazards and transportation development scenarios. The group also listened to presentations on the Coastal Energy Impact Program, the final 5-year OCS leasing program for Alaska, and a case history of the Lower Cook Inlet Sale.

During the fifth meeting of the Alaska RTWG, held on June 2 and 3, 1980, in Juneau, the group reviewed proposed lease stipulations for Sale 55 (Gulf of Alaska). It also identified factors that needed consideration in the petroleum development scenarios for proposed Sales 57 and 70 and formed a subcommittee to review the FY 1981 Studies Plan and the draft FY 1982 Studies Plan.

The most recent meeting of the Alaska RTWG was held in Anchorage on July 23 and 24, 1980. The group considered and adopted the subcommittee recommendations on the FY 1981 and FY 1982 Regional Studies Plans and identified issues for consideration in the envi-

ronmental impact statement for proposed Sale 71 (Beaufort Sea). Issues identified for proposed Lease Sale 71 included impacts on resident species of marine mammals and caribou, impacts to the subsistence lifestyle, and dynamic ice conditions. In addition, a subcommittee was formed to begin work on a Phase I Status Report for Lease Sale 55. The current membership of the Alaska RTWG was given in table 5 (p. 28).

PRE-LEASE SALE ACTIVITIES

The objective of the IPP's Pre-Lease Sale Activities is to assist in coordinating all activities leading up to a lease sale decision. These activities begin prior to the Call for Nominations and terminate with the Sale Decision. Most activities concern the exchange and assessment of information so that recommendations can be made at the time of tentative tract selection. Information needs related to the subsequent preparation of Regional Study Plans and Transportation Management Plans are also a part of this activity. Pre-Lease Sale Activities can last about 2 years. They are completed by the time of a sale decision. A summary of the IPP Pre-Lease Sale Activities and their relation to OCS Field Office actions is presented in table 6.

ENVIRONMENTAL STUDIES PROGRAM

The BLM's Environmental Studies Program was initiated in 1973 by the Secretary of the Interior through a commitment to perform investigations of certain environmental features of the Gulf of Mexico. The program was formalized in section 20 of the Outer Continental Shelf Lands Act Amendments of 1978 43 U.S.C. 1331 et seq., which requires the Secretary to conduct a study of any area or region included in any oil and gas lease sale in order to establish information needed for assessment of the human, marine, and coastal environments of the Outer Continental Shelf

TABLE 6.—OCS Pre-Lease Sale Activities

OCS Pre-Lease Sale Activity	OCS Field Office action	OCS Field Office IPP action
Area of Call outlined	Letter to Federal and State Agencies.	
Resource Reports requested, received, and analyzed	Inter-Bureau Coordination (2974) meeting with U.S. Geological Survey (USGS).	
Call for Nominations and Comments issued	Notice of Call sent to the Federal Register. Nominations comments sent to BLM Washington Office (WO), USGS, and OCS office.	IPP working group has an opportunity to review the Area of Call and to provide comments on any aspect of the area to BLM.
Resource Portrayals for Tentative Tract Selection	Environmental Assessment (EA) and Operations staff prepare resource portrayals as one of four inputs to tract selection. Other inputs are: (1) resource estimates from USGS, (2) nominations from industry, and (3) comments from concerned individuals, organizations, and governmental agencies.	IPP working group has an opportunity to listen to and view the resource portrayals and to make its own recommendations on blocks to be deleted and those to be included for further consideration.
Joint Tract Selection Meeting	2974 meeting to develop joint recommendations for tentative tract selection.	
Tentative Tract Selection	Joint tract selection memo prepared for transmittal to WO.	
Scoping	Meetings held and responses solicited from various publics, including communities adjacent to or affected by the proposed sale to solicit a listing of critical issues to be discussed in the Environmental Impact Statement (EIS) process, and to develop alternatives to the proposal.	IPP working group has an opportunity to act as a "technical public" in identifying issues that need addressing in the EIS process, and to develop alternatives to the proposal.
Development of Petroleum Development Scenarios for use in the EIS	BLM letter to USGS asking for information on resources, the timing of resource development, methods and modes of OCS exploration and production, possible facility sites and facility types, pipelines if necessary, support activities, and locations and oil spill cleanup capability. BLM develops tentative scenarios for the EIS on which subsequent impacts are based. This includes the proposal as well as alternatives.	IPP working group has an opportunity to be involved in early planning stages by assisting in developing the scenarios. Important time to utilize local ad hoc members. Recommendations based on local Coastal Zone Management (CZM) plans, land use and land status, and the most current information available. In addition, a look at what information is not available and what additional information will be needed. Recommendations could be in the form of potential facility sites needing further study as well as possible corridor routes.
Oil Spill Risk Analysis Model (OSRAM)	Letter from BLM to USGS requesting that the OSRAM be run.	
Draft Environmental Impact Statement (DEIS)	Preparations of DEIS by EA with input from operations and studies.	IPP may be contacted as a group or as individuals to support/assist in EIS preparation and review throughout.
Review of DEIS	Public hearings held.	IPP working group has an opportunity to comment on the proposed mitigation measures designed to reduce or eliminate problems that may occur when a lease area is developed, and on other aspects of the DEIS.
Final Environmental Impact Statement	Rewrite based on comments.	
Secretarial Issue Document (SID)	WO and FO staff prepare the SID, which summarizes and analyzes the major issues and options available to the Secretary.	

TABLE 6.—OCS Pre-Lease Sale Activities (Continued)

OCS Pre-Lease Sale Activity	OCS Field Office action	OCS Field Office IPP action
Proposed Notice of Sale (PNS)	Federal Register notice describing proposed terms and conditions of the proposed sale.	IPP working group has an opportunity to review and comment on the PNS.
Receipt of Comments on PNS's	Comments received, in particular those from the State, are evaluated and changes in notice are made as appropriate.	
Notice of Sale	Copies of Federal Register notice sent to interested OCS publics describing terms and conditions of the proposed sale.	
Sale	Opening and reading of bids by the office manager at time and place specified in the Notice of Sale.	

SOURCE: Euler, 1979.

and the coastal areas that may be affected by oil and gas development there.

The Environmental Studies Program is under the direction of the Bureau's Assistant Director, Energy and Mineral Resources. This position is held by Dr. Irwin White. The program consists of an environmental studies division in each of the Bureau's OCS offices (New York, New Orleans, Los Angeles, and Anchorage) and the Branch of Offshore Studies in Washington, D.C. The OCS offices have the responsibility for developing statements of regional study needs (Regional Study Plans), preparing statements of work, and monitoring contractor performance on all approved regional studies. The Branch of Offshore Studies in Washington has the overall management, planning, and budgeting responsibility for the studies program. The Chief of the Branch of Offshore Studies is responsible for the technical adequacy of the program and its component studies. The Branch of Offshore Studies prepares program guidance for the OCS offices to use in the preparation of Regional Study Plans, establishes national priorities, compiles the National Study Plan, and manages studies that are applicable to more than one leasing region.

The normal process of defining the National Study Plan usually begins with the Branch of Offshore Studies, through the Assistant Director, establishing the schedule for the OCS offices to prepare Regional Study

Plans. These plans include statements of regional study needs, the regional perspective on the priorities of these needs, and a brief description of each proposed study. The Branch of Offshore Studies reviews draft Regional Study Plans from all four OCS offices for programmatic consistency, cost, use of ranking criteria, and relevance to issues of national interest, and the OCS offices revise their respective study plans accordingly. Following the submission of final study plans, the Branch of Offshore Studies compiles a preliminary National Study List.

The total cost of all studies nominated for funding during any fiscal year has historically exceeded available funds. As a result of this, the BLM devised a set of ranking criteria to establish the priority of studies on the National Study List. The current ranking criteria, developed jointly by the Bureau and the Office of Management and Budget, are as follows:

- importance of the information to the decisionmaker;
- date of the decision for which the study is designed;
- generic applicability of results or techniques from the study;
- status of the information; and

- applicability of the study to issues of regional or programmatic concern.

Each proposed study is ranked by the nominating OCS office using these five criteria. The Branch of Offshore Studies then reviews each OCS office's use of the criteria, makes any revisions that are required, and prepares a preliminary National Study List from the Regional Study Plans. The resulting list of studies is reviewed and approved by all four OCS managers and then submitted to the Assistant Director for formal approval. Upon the Assistant Director's approval, each OCS office is formally notified of its list of approved studies and its studies allocation. Each OCS office then provides Washington with a schedule for procurement of the approved studies.

The OCS offices are required to procure the studies on the approved studies list unless a proposed change is approved by the BLM's Assistant Director, Energy and Mineral Resources. This permits the OCS offices to respond to unanticipated study needs that arise after compilation of study plans.

The RTWG Committees are also involved in the development of regional study programs. These groups help to determine the issues that require study and their importance to regional decisionmakers. They may recommend studies and become involved in ranking the candidate studies using the BLM's criteria. Each Working Group reviews the draft Study Plan for its region. The RTWG's are briefed on the status of regional studies on the national list and may be involved in preparing the final drafts of the Regional Study Plans. The Working Groups are advised of studies that are approved for funding, and they compile the plans for the following year's Regional Study Plan based upon this information. The Working Groups may also be involved in the design of approved studies.

The Environmental Studies Program is reviewed by the Scientific Committee of the OCS Advisory Board. This committee has the responsibility to review the appropriateness, feasibility, and scientific merit of the program's component studies. The committee

may comment on any study in the program, including those nominated by the RTWG's.

The Alaska OCS Socioeconomic Studies Program (SESP) was created by the BLM as a part of the Environmental Studies Program to determine and assess the potential social, economic, and physical impacts onshore from OCS oil and gas development in Alaska. The SESP is concerned with the entire development process, beginning with the assembly of pre-development information. Economic analyses of rural and urban communities, regions within the State, and the State as a whole, with assessments of both natural and manmade features, are also performed under the SESP.

The SESP began in 1976, when oil and gas exploration activities were under way following the first Alaska OCS lease sale-- Lease Sale 39, in the Northern Gulf of Alaska. Because the decisionmaking process requires a long lead time before a sale, the SESP studies that began in 1976 focused on the proposed December 1979 Federal/State Beaufort Sea Sale (Sale BF). These studies were completed early in 1978. Studies are nearing completion or have been completed for the Northern Gulf of Alaska, Lease Sale 55; Kodiak, Lease Sale 61; the area of the second Lower Cook Inlet sale, Lease Sale 60; and the Bering Sea-Norton Basin, Lease Sale 57.

Beginning in 1980, studies will be conducted for the St. George Basin (Lease Sale 70), Beaufort Sea (71), North Aleutian Shelf (75), Navarin Basin (83), and Chukchi Sea (85) sale areas.

The general process followed in all SESP impact evaluations is based on a comparative analysis of changes likely to occur at the State, regional, or local levels. The small local coastal communities are generally expected to receive the direct, physical effects of OCS development, while the State as a whole is usually expected to receive the indirect, nonphysical effects of such development. The SESP conducts both baseline and impact investigations, which are often combined.

The current structure of the Environmental Studies Program is complex. It contains checks and balances designed to support

both regional and national needs. Although the system is still in an evolutionary phase, the results to date are encouraging.

PHASES OF THE IPP

The IPP has four phases. These phases are geared to each lease sale the BLM holds. Decisions are made in each phase that determine the manner in which development will take place. The phases are discussed below and shown in figure 24.

Phase I

The objective of the IPP efforts during Phase I is to assist in coordinating all activities leading up to a lease sale decision. This phase begins prior to the Call for Nominations and terminates with the Sale Decision. During Phase I, the RTWG may provide information and make recommendations regarding tract selection and mitigating measures considered in draft and final environmental impact statements and Secretarial Issue Documents. Information needs related to the later preparation of Regional Study Plans and Transportation Management Plans are also a part of this Phase.

Phase I can last about 2 years. It is completed by the time of a sale decision. Lease Sale 55 in the Gulf of Alaska, tentatively scheduled for October 1980, Lease Sale 60 in Cook Inlet, tentatively scheduled for September 1981, and Lease Sale 61 (Kodiak), as well as all other lease sales on the Current 5-year Oil and Gas Leasing Schedule (table 1, p. 4), are in Phase I.

Phase II

Phase II of the IPP is formally implemented at the time of publication of the Proposed Notice of Sale in the Federal Regis-

ter. During this Phase, each RTWG recommends regional and generic studies that should be included in a Regional Study Plan to be drawn up during Phase III. Other Federal, State, or local agencies may benefit from the coordination process. The exchange of information that is prompted by the recommendations of the RTWG helps to identify information gaps or overlaps.

Phase II should be completed by the time a discovery of commercial quantities of oil and/or gas is made. Technically, Lease Sales CI and 39 are in Phase II of BLM's OCS program; however, these lease sales were held prior to the formation of IPP and have not been incorporated into the process due to the low level of activity.

Phase III

Phase III of the IPP program begins with the announcement of a discovery of hydrocarbons in marketable quantities in the region. Due to the fact Alaska is a single-State Region, there will be no State Technical Working Group; instead, a Sub-State Technical Working Group will be formed to refine potential transportation corridors. The Sub-State Technical Working Group includes all Federal and private members of the RTWG as well as ad hoc members of the affected areas.

This Group recommends site-specific studies to be included in the Phase III Site-Specific Studies Plan. Site-specific studies may be funded by the BLM, other Federal agencies, State or local governments, or private groups.

Because there have not been marketable discoveries of oil or gas on the Alaska OCS since the activation of the IPP, a Sub-State Technical Working Group has not yet been formed.

Phase IV

During Phase IV, a Regional Transportation Management Plan is developed. Phase

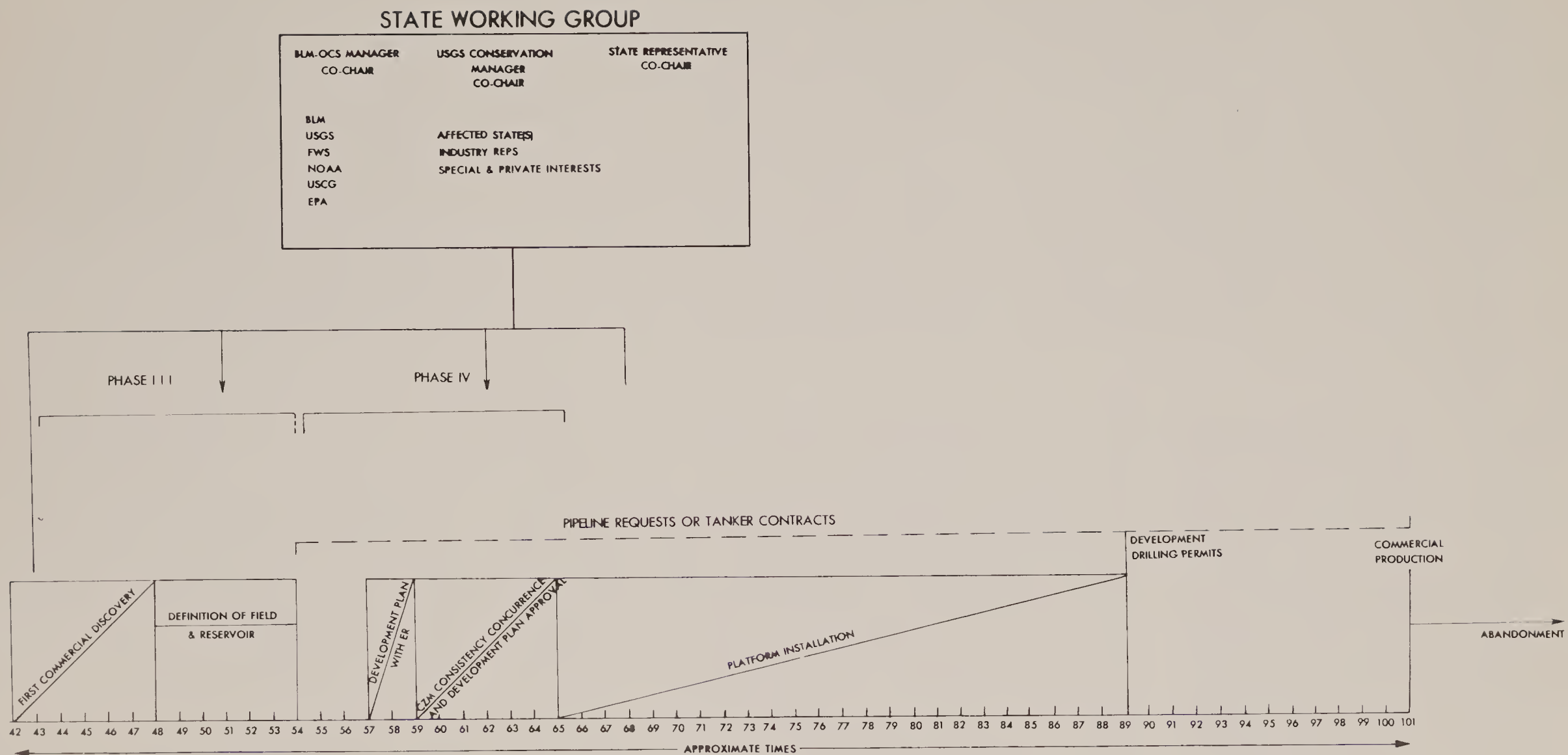


FIGURE 24.—Relationship of the IPP to the BLM's OCS program (Rodgers, 1979).

IV begins as soon as transportation studies are complete and should either precede or coincide with industry's submittal of the first Development and Production Plan.

The four phases of the IPP program together form a long-range planning and coordination effort. While its actual timing varies from region to region and from sale to sale, the estimated minimum time for completion of the four phases of the IPP program is approximately 4-1/2 to 5 years. However, the process could conceivably take as long as 9 years (BLM, 1979).

SUMMARY

The IPP's third element, Transportation Planning, was discussed in chapter 3. Together, the three elements--the Leasing Process, Environmental Studies Program, and Transportation Planning--make up the entire Intergovernmental Planning Program for OCS Oil and Gas Leasing, Transportation and Related Facilities in Alaska. Members of the Alaska RTWG will be actively involved in each element, providing input and participation at specified steps in the process.

Appendix D. OCS-Related Studies

One of the best sources of Federal, State, and local studies concerning Alaska is the Arctic Environmental Information and Data Center (AEIDC). AEIDC, a research unit of the University of Alaska, was established in 1972 by the Alaska State Legislature. The major objective of AEIDC is to provide referral to and dissemination of resource information about Arctic regions with emphasis on the Alaskan environment.

The Information Services staff of AEIDC provides information referral, continually develops and maintains specialized information files, and conducts information retrieval and dissemination. AEIDC's collection of 8,000 documents includes materials that are unpublished or out-of-print. Those not restricted by copyright can be reproduced for a minimal charge. Information retrieval and dissemination is augmented by computerized data bases.

FEDERAL STUDIES

U.S. Department of the Interior:

Bureau of Land Management

The Alaska OCS office of the U.S. Department of the Interior, Bureau of Land Management, carries on an Environmental Studies Program to provide information for the OCS decisionmaking process. Appendix C describes this program. Although most studies are available from the National Technical Information Service (NTIS), they may also be reviewed at the Alaska OCS Office of the Bureau of Land Management, 620 East 10th Ave-

nue, Anchorage, AK 99510, or at the Washington OCS Office of the Bureau of Land Management, 18th and C Streets, NW, Washington, DC 20240.

Mathematical Sciences Northwest, Inc., and Human Resources Planning Institute, Inc., 1976, A social and economic impact study of offshore petroleum and natural gas development in Alaska, phase I: Washington, D.C., 406 p. Prepared for the Bureau of Land Management. Available from NTIS, U.S. Department of Commerce, Springfield, VA 22161.

This report presents the first phase of a two-phase study dealing with socioeconomic impacts of OCS development in southern Alaska. It provides an analysis of an effort to model Alaska's economic experience with hydrocarbon development in the Kenai-Cook Inlet region. Phase II of the study presents the application of the modeling techniques to areas that have potential for future hydrocarbon development and the projection of the nature and range of socioeconomic impacts that could take place.

The Phase I report examines the linkages between the petroleum sector and the rest of the Alaskan economy. Kenai's proximity to Anchorage encouraged the economic integration of Kenai with the rest of the State and allowed for the dispersion of the development impacts with the entire region, including Anchorage and the Kenai area.

Dames & Moore, 1978, Monitoring petroleum

activities in the Gulf of Alaska between April 1975 and March 1978: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 17, 72 p. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 285408/AS).

The main objective of this study is to present a detailed historical account of drilling activity on the OCS in the Northern Gulf of Alaska and Lower Cook Inlet that occurred between April 1975 and June 1978. The report includes information about the number, timing, location, depth, and results of wells drilled; equipment used; employment created; wages paid; transportation routes used; and communities impacted.

Davis, Nancy Yaw, 1978, Historical indicators of Alaska native cultural change: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 15, 148 p. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 294180 /AS).

This report is based on a search of the anthropological literature on the culture and history of Alaskan native coastal communities and populations, and considers the previous impact of modernization on social and cultural change. The report synthesizes the relevant parts of the anthropological literature to identify historically documented change, and to suggest how those previous changes influence further change.

Ender, Dr. Richard L., and others, 1978, Anchorage socioeconomic and physical baseline: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 12, 148 p. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 284568 /AS).

This document is a community profile on the Municipality of Anchorage encompassing socioeconomic and physical data. Topics include a brief history

of the inception of Anchorage as a township with an overview of significant historical events; a comprehensive discussion of the Anchorage economy and current demographic information; local government revenues and expenditures; community support service sectors including health services, social services, leisure and recreational services, education, police, fire, and emergency medical services; physical characteristics of Anchorage; utilities; and transportation. Within each section, where applicable, current issues are identified and planning efforts designed to alleviate problem areas are discussed.

Alaska Consultants, Inc., 1979, Northern and western Gulf of Alaska local socioeconomic baseline: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 32, 539 p. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 296971/AS).

This report provides a review of existing population and economic conditions in Yakutat, Cordova, Seward, and Kodiak; an overview of land use patterns, land tenure, and housing conditions in and around these communities; an outline of specified community facilities and utilities services; and a review of local government powers and the financial condition of each community. An analysis of social conditions affecting Yakutat is also included.

Alaska Consultants, Inc., Northern Gulf of Alaska petroleum development scenarios: local socioeconomic impacts: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Report no. 33, 347 p., and appendix. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 80-154487/AS).

This report characterizes the socioeconomic impact on Yakutat, Cordova and Seward of base case (no OCS development) and of three different OCS

petroleum development scenarios. The analyses of the petroleum scenarios stresses the noteworthy departures from base case conditions. Although the report cannot account for various local decisions, it makes possible comparisons of the trend of growth impacts in the various communities.

Dames & Moore, 1979, Northern Gulf of Alaska petroleum development scenarios: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 29, approx. 340 p. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 294-229/AS).

This report presents petroleum development scenarios for the Northern Gulf of Alaska Lease Sale No. 55. Using USGS resource estimates, scenarios are developed for high find, medium find, and no commercial resources. Each scenario is detailed according to facilities, equipment, and manpower requirements centered around an economic analysis of various production systems currently in the North Sea. The economic analysis defines the minimum economic field size to justify development in the Gulf of Alaska and the minimum required price to justify development of a field in the Gulf.

Habitat North, Inc., 1979, Socioeconomic impact of selected foreign OCS developments: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 28, 314 p. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 297-114/AS).

This report discusses various aspects of socioeconomic change in Scotland resulting from exploration and development of offshore hydrocarbon reserves in the North Sea. A number of impacts are documented and the relevance of these impacts to the Alaska OCS is discussed. A brief section at the end of the report examines some of the

socioeconomic issues in offshore exploration in the Canadian portion of the Beaufort Sea.

Huskey, Lee, and Nebesky, William, 1979, Northern Gulf of Alaska petroleum development scenarios: economic and demographic impacts: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 34, 478 p. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 297722/AS).

This study examines the impact of potential Outer Continental Shelf petroleum development in the Northern Gulf of Alaska. Development of these resources was assumed to result from Lease Sale 55 scheduled to be held in October 1980. The study presents economic and demographic effects on both the State of Alaska and the Gulf of Alaska subregion.

Kruse, John, Hitchius, Diddy, and Baring-Gould, Michael, 1979, Developing predictive indicators of community and population change: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 26, 343 p., and appendix. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 294-229/AS).

This report focuses on different community and individual responses to outside forces for change. The results of the Predictive Indicator Study identify key community and individual characteristics that must be addressed in community baseline studies. A means of using these baseline studies to make predictions concerning OCS activity is also given.

Peat, Marwick, Mitchell & Co., 1979, Definition of Alaska petroleum development regions: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 1, 69 p. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 80-108707).

The purpose of this report is to define boundaries for petroleum development regions in Alaska. These boundaries provide initial data-gathering and impact analysis areas that will be refined and altered as petroleum development scenarios and other research products become available. The boundaries defined in this report generally accord with those of native corporations in on-shore areas adjacent to lease sale areas; however, they are further modified to accord with certain labor, census, and political boundaries.

Alaska Consultants, Inc., 1980, Lower Cook Inlet petroleum development scenarios: local socioeconomic systems and analysis: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 46, 2 vols., 675 p., and appendix. Available from Coordinator, Socioeconomic Studies Program, Alaska OCS Office, P.O. Box 1159, Anchorage, AK 99510.

Volume I of this two-volume report reviews existing population and economic conditions in the Kenai Peninsula Borough and the communities of Kenai, Soldotna, and Homer. For the communities it presents an overview of land use patterns, land tenure, housing conditions, an outline of specified community facilities, a review of local government powers, and the financial condition of each locality. Volume II analyzes how the growth and community infrastructure of these settlements might be affected.

Braund, Stephen R., and Behnke, Steven R., 1980, Lower Cook Inlet petroleum development: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 47, 428 p., including bibliography. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 80-166655).

An analysis and evaluation of the OCS impacts on the sociocultural systems of the study communities was the goal of this report. It describes the past and existing trends in the sociocultural

systems of certain Cook Inlet communities and projects these conditions both with and without OCS oil and gas activities resulting from Lease Sale 60.

Eakland, Peter, and Joshi, Raj, 1980, Lower Cook Inlet petroleum development scenarios: transportation systems analysis: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 45, 284 p., and appendix. Available from Coordinator, Socioeconomic Studies Program, Alaska OCS Office, P.O. Box 1159, Anchorage, AK 99510.

This study analyzes potential transportation impacts resulting from proposed Lease Sale 60. Transportation impacts are expected to begin in 1982 with exploration drilling and to continue 20 years through the year 2001. The analysis of local and regional terminals and facilities is limited to Homer, Kenai-Soldotna, and Anchorage. Route analysis extends to the regional and interstate levels.

Ender, Richard L., Gehler, Jan, and Goiski, Susan, 1980, Gulf of Alaska and Lower Cook Inlet petroleum development scenarios: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 48, 2 vols., 728 p., including bibliography. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Vol. 1 (PB 80-166663), vol. 2 (PV 80-166671).

The first volume of this two-volume study provides a profile of Anchorage. It examines historical trends and current data, identifies key issues and problems within specified sectors of the community, and explores planning processes designed to respond to critical issues. It provides the necessary baseline information for the analysis of proposed OCS development in all parts of Alaska. The second volume provides an OCS impact analysis of Anchorage.

Klein, R., Mogford, M., and Withers, B., 1980, Monitoring oil exploration activities in

the Lower Cook Inlet: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 55, 205 p. Limited number of copies available from Coordinator, Socioeconomic Studies Program, Alaska OCS Office, P.O. Box 1159, Anchorage, AK 99510.

The objective of this study is to provide an accurate historic account of the events and effects of OCS activity related to Lower Cook Inlet Lease Sale CI between the period of October 1977 and January 1980. The report describes the basic technical materials, personnel, cost, and wage data concerned with operations related to the Lower Cook Inlet sale and the major effects and impacts of the exploration activity on local communities. Public service demands, prices, business cycles, labor effects, community attitudes, and other factors are discussed in relation to the sale. The last chapter of the report presents the major conclusions.

Lane, Ted, and Withers, Barbara, 1980, Lower Cook Inlet petroleum development scenarios: economic and demographic analysis: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 42, 256 p. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB 80-166705).

This study consists of three major parts: (1) a baseline study of the economies of the State and its Gulf of Alaska region, (2) a base case projection describing the future economy without Lower Cook Inlet OCS development, and (3) an examination of the impact of Lower Cook Inlet OCS development. The model used in the analysis of OCS development scenarios is the statewide econometric model of the Alaskan economy developed in the Man-in-the-Arctic Program (MAP) at the University of Alaska.

Terry, Joseph M., Scales, Roger G., and Larson, D.M., 1980, Lower Cook Inlet petro-

leum development scenarios: commercial industry analysis: Anchorage, Alaska, BLM Alaska OCS Office, Socioeconomic Studies Program, Technical report no. 44, 531 p., including bibliography. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161.

The subject of this study is potential interaction of the commercial fishing industry and the OCS oil and gas industry that is likely to occur as a result of proposed Lease Sale 60 in Lower Cook Inlet. In this report, past levels of harvesting and processing activity are documented, future levels of activity are projected through the year 2000 in the absence of OCS petroleum activity, and the potential differences that may occur as a result of various levels of OCS activity are analyzed for the five communities in the Cook Inlet and Shelikof Strait regions.

U.S. Geological Survey

Plafker, G., Bruns, T.R., and Page, R.A., 1975, Interim report on petroleum resource potential and geologic hazards in the Outer Continental Shelf of the Gulf of Alaska Tertiary province: U.S. Geological Survey Open-File Report 75-592, 73 p. Available from Open-File Services Section, USGS, Box 25425, Federal Center, Denver, CO 80225.

This report provides a preliminary summary of the status of knowledge concerning petroleum potential and possible earthquake-related hazards in the Gulf of Alaska Tertiary province. The report was included in the EIS and used in selecting the tracts to be leased for petroleum exploration during Lease Sale 39 in the Northern Gulf of Alaska.

Magoon, L.B., and others, 1976, Hydrocarbon potential, geologic hazards, and infrastructure for exploration and development of the Lower Cook Inlet, Alaska: U.S. Geological Survey Open-File Report 76-449, 124 p. Available from Open-File

Services Section, USGS, Box 25425, Federal Center, Denver, CO 80225.

This report is a summary of the geologic framework, petroleum geology, oil and gas resources, environmental geology, and operational considerations of the Lower Cook Inlet OCS area. The report also provides a preliminary assessment of the availability of drilling units and manpower, the time frame for possible oil and gas development of the Lower Cook Inlet area, and comments on capital, manpower, and infrastructure necessary for development.

Plafker, George and others, 1978, Petroleum potential, geologic hazards, and technology for exploration in the Outer Continental Shelf of the Gulf of Alaska Tertiary province: U.S. Geological Survey Open-File Report 78-490, 33 p. Available from Open-File Services Section, USGS, Box 25425, Federal Center, Denver, CO 80225.

This report provides an assessment of the petroleum potential, geologic framework, environmental geology, and technology for development on the OCS in the Northern Gulf of Alaska. It amplifies Open-File Report 75-592, which was prepared prior to selection of tracts to be leased for petroleum exploration in the Lease Sale 39 area. This report summarizes the earlier work and emphasizes new data that have become available since the pre-nomination report was prepared in December 1975.

Magoon, L.B., and others, 1979, Resource report for proposed OCS Sale No. 60, Lower Cook Inlet-Shelikof Strait: U.S. Geological Survey Open-File Report 79-600, 38 p. Available from Open-File Services Section, USGS, Box 25425, Federal Center, Denver, CO 80225.

This report summarizes the framework geology, petroleum geology, resource assessment, sale outline, environmental geology, and time frame and infrastructure for development of the Lower Cook Inlet and Shelikof Strait. The report was prepared for BLM to aid

the Bureau in preparing for Lease Sale 60.

U.S. Fish and Wildlife Service

Hershman, Marc J., and Feldman, James H., 1978, Environmental planning for offshore oil and gas, volume V: regional status reports, part 5: Alaska, Washington, Oregon: The Conservation Foundation, Washington, D.C., 127 p. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161 (PB281-450).

This report presents an overview of the status of offshore oil and gas activities and impacts for the States of Alaska, Washington, and Oregon. It is organized into five major sections: (1) past and present OCS production, (2) OCS development and future potential, (3) effects on living resources, (4) socioeconomic impacts, and (5) regional information analysis. The report is one of five regional status reports sponsored by the U.S. Fish and Wildlife Service, Office of Biological Services.

U.S. Department of Commerce:

National Oceanic and Atmospheric Administration

Science Applications, Inc., 1979, Environmental assessment of the Alaskan Continental Shelf: Lower Cook Inlet interim synthesis report: Boulder, Colo., 241 p. Available from U.S. Department of Commerce, NOAA Environmental Research Laboratories, Boulder, CO 80303.

This report synthesizes all available marine environmental information pertinent to OCS development for the Lower Cook Inlet Lease Sale area. The information is presented in six chapters: (1) existing contaminants, (2) sources, (3) hazards, (4) transport, (5) receptors, and (6) effects. A synthesis chapter that provides a perspective on the current state of knowledge for the lease area is provided at the end of the report.

U.S. Department of Transportation:**U.S. Coast Guard**

U.S. Coast Guard, Seventeenth Coast Guard District, 1978, Annex G, CCGD17 OPLAN No. 1, Marine environmental protection plan: Juneau, Alaska, 1 p. and appendixes. Available from Commander, Seventeenth Coast Guard District, P.O. Box 3-5000, Juneau, AK 99802.

The purpose of this Annex is to assign specific responsibilities and procedures for effective marine environmental protection activities within the Seventeenth Coast Guard District. Unlike the Contingency Plan, this Annex assigns specific responsibilities within the Coast Guard.

U.S. Coast Guard, Seventeenth Coast Guard District, 1979, Alaska coastal multi-agency oil and hazardous substances, pollution contingency plan: Juneau, Alaska, 16 p. and annexes. Available from Commander, Seventeenth Coast Guard District, P.O. Box 3-5000, Juneau, AK 99802.

This plan and its annexes provide a pattern of coordinated and integrated response by agencies of the Federal and State governments to pollution incidents. It establishes a regional response team, local contingency plans, and local response teams. The plan promotes the coordination of Federal, State, and local response systems and encourages the development of capabilities by both local governments and private interests to handle or prevent pollution incidents.

STATE STUDIES**Alaska**

Alaska Consultants, Inc., 1976, Marine service bases for offshore oil development: Anchorage, Alaska, 87 p., including bibliography. Available from the Alaska Department of Community and Regional

Affairs, Division of Community Planning, Pouch B, Juneau, AK 99811.

This report describes service bases that have demonstrated their efficiency in the North Sea, an area that is similar to the Gulf of Alaska in many ways. The economic, social, and environmental disruptions resulting from a service base are considered.

Dornbursch, David M., and Company, Inc., 1976, Management of OCS-related industrial development: a guide for Alaskan coastal communities: San Francisco, Calif., 148 p. Available from Alaska Department of Community and Regional Affairs, Division of Community Planning, Pouch B, Juneau, AK 99811.

This report describes the alternative management tools and procedures that are available to Alaskan communities to achieve diverse community needs and objectives related to OCS activity. The report is divided into three parts: (1) Part I, describing the fundamental actions necessary for communities to manage OCS-related development; (2) Part II, containing a discussion of the three types of tools available to manage onshore developments--leasing, public powers, and indirect methods; and (3) Part III, suggesting ways to use the management tools to achieve particular financial, economic, social, and environmental objectives.

Woodward-Clyde Consultants, 1977, Oil terminals and marine service base sites in the Kodiak Island Borough: Anchorage, Alaska, 221 p. Executive summary available from the Alaska Department of Community and Regional Affairs, Division of Community Planning, Pouch B, Juneau, AK 99811.

This study evaluates and ranks possible sites for marine service bases and oil terminals in the Kodiak Island Borough. Its purpose is to assist the State and Borough in planning for impacts resulting from OCS development.

Hayes, Miles O., Brown, P. Jeffery, and Michel, Jacqueline, 1976, *Coastal morphology and sedimentation, Lower Cook Inlet, Alaska, with emphasis on potential oil spill impacts: Columbia, S.C., 95 p., including bibliography and appendix. Available for review at Department of Fish and Game, Anchorage, AK.*

A regional assessment of coastal morphology and sediments is provided in this report. Twelve hundred kilometers of shoreline were categorized as erosional, depositional, or neutral on the basis of ground studies at 57 localities, and more detailed sediment and morphologic studies were conducted at 10 selected sites. This categorization provides the basis for prediction of the behavior of oil spills in the area.

Kramer, L.S., Clark, V.C., and Cannelos, G.J., 1978, *Planning for offshore oil development, Gulf of Alaska handbook: Juneau, Alaska, 275 p. Available from the Alaska Department of Community and Regional Affairs, Division of Community Affairs, Pouch B, Juneau, AK 99811.*

The purpose of this document is to clarify the nature of OCS oil and gas activities in the waters of Alaska and what these activities mean to Alaskans. It also discusses the State policies on OCS development and the cooperation and coordination needed among local and State governments so that related on-shore activities will confer the most benefit and least harm. Specific topics include leasing and exploration, development scenarios, industry profiles, facility siting, employment estimates, and population and public services.

Hamilton, Carole I., Starr, Suzanne, and Transky, Lance L., 1979, *Recommendations for minimizing the impacts of hydrocarbon development on the fish, wildlife, and aquatic plant resources of Lower Cook Inlet: Anchorage, Alaska, 2 vols., 397 p., and maps. Available from the Alaska Department of Fish and Game, Marine/Coastal Habitat Management, Anchorage, AK 99502.*

There are three parts to this report: (1) a narrative report; (2) resource inventory maps of fish, wildlife, and aquatic plants in Lower Cook Inlet; and (3) impact maps showing the relative sensitivity of fish and wildlife habitats to oil-and gas-related activities. The narrative includes a description of the area and of oil and gas activities, as well as recommendations for mitigating the adverse impacts on fish, wildlife, and aquatic plant resources.

Kramer, Lois, Fargnoli, Jack, and Rickey, Allison, 1979, *Community planning and development for the bottomfish industry, phase I: Juneau, Alaska, 419 p. Available from the Alaska Department of Community and Regional Affairs, Division of Community Planning, Pouch B, Juneau, AK 99811.*

The Department of Community and Regional Affairs prepared this publication as a first phase of the State's Bottomfish Community Development Program. The report identifies existing industrial and community facilities and any deficiencies in the infrastructure necessary to support a bottomfishing industry. The communities examined are Unalaska, Kodiak, Seward, Yakutat, and Sitka.

LOCAL STUDIES

Brogan, Michael D., and Waits, Ike D., 1977, *OCS development: a headache or a blessing? The choice is Homer's: Kenai, Alaska. Available from Kenai Peninsula Borough, Box 850, Soldotna, AK 99669.*

Brogan, Michael D., and Waits, Ike D., 1977, *OCS development: a headache or a blessing? The choice is Kenai's: Kenai, Alaska. Available from Kenai Peninsula Borough, Box 850, Soldotna, AK 99669.*

Brogan, Michael D., and Waits, Ike D., 1977, *OCS development: a headache or a blessing? The choice is Seldovia's: Kenai, Alaska. Available from Kenai*

Peninsula Borough, Box 850, Soldotna, AK 99669.

Brogan, Michael D., and Waits, Ike D., 1977, OCS development: a headache or a blessing? The choice is Seward's: Kenai, Alaska. Available from Kenai Peninsula Borough, Box 850, Soldotna, AK 99669.

Brogan, Michael D., and Waits, Ike D., 1977, OCS development: a headache or a blessing? The choice is Soldotna's: Kenai, Alaska. Available from Kenai Peninsula Borough, Box 850, Soldotna, AK 99669.

All five of these reports discuss the positive and negative effects of OCS development as they may affect the particular community. The reports were designed to reduce confusion concerning OCS development.

Mielke, Frank G., 1977, Annotated bibliography of writings in Kenai Peninsula Borough Planning Department Library relating to planning and coastal zone management: Soldotna, Alaska, 71 p. Available from Kenai Peninsula Borough, Box 850, Soldotna AK 99669.

This bibliography contains a listing of publications in the Kenai Peninsula Borough Planning Department Library. Each listing is accompanied by a brief description of contents and of its applicability to planning in general, and more specifically to coastal zone management and OCS development.

CH2M Hill, 1978, Offshore oil development in Lower Cook Inlet: implications for the Kenai Peninsula: Kenai Peninsula Borough and Department of Community and Regional Affairs, State of Alaska, 307 p. Available from Alaska Department of Community and Regional Affairs, Division of Community Planning, Pouch B, Juneau, AK 99811.

This report examines the nature and extent of the effects of OCS oil exploration in Lower Cook Inlet on Kenai

Peninsula Borough residents. It proposes strategies that the Borough, cities, and individuals could use to gain the greatest benefit from OCS development. The recommendations provided in the report include a range of options for the cities and Borough to consider in preparing for development. The major sections in the report deal with onshore facility siting, economic conditions, population, transportation, housing, community services and facilities, finances, and development guidelines relevant to the Kenai Peninsula Borough.

Kenai Peninsula Borough, 1980, Situations and prospects: Soldotna, Alaska, 129 p. Available from Kenai Peninsula Borough, Box 850, Soldotna, AK 99669.

The goal of this report is to distribute data measuring economic and social changes in the Borough to community residents, businessmen, and local officials. It also seeks to record and analyze community changes resulting from oil and gas development. The report has three major sections: statistical indicators, recent activities, and prospects.

Glossary

Definitions presented in the Glossary describe terms as they have been used in this Summary Report. The Glossary is intended for general reference only: for detailed descriptions of technical or specialized terms, the reader should seek a reference in the field of particular interest. Abbreviations and acronyms are presented in tabular form on p. ii.

Sources used in compiling this glossary were the Gulf of Alaska Summary Report itself; the Mid-Atlantic, South Atlantic, and Pacific Summary Reports, the OCSI (formerly OCSIP) Atlantic, Pacific, Gulf of Mexico, and Alaska Indexes; Webster's Third New International Dictionary; the American Geological Institute's Dictionary of Geological Terms; and Langenkamp's Handbook of Oil Industry Terms and Phrases (2d ed.).

Alaska Native Claims Settlement Act (ANCSA) of 1971 - Act of Congress entitling Alaska natives to 16 million hectares (40 million acres) selected and held primarily by native village corporations and regional corporations, both of which are private entities.

Alaska Peninsula - Cook Inlet Province - A long narrow wedge of moderately deformed marine clastic rocks of late Mesozoic age and predominantly nonmarine rocks of Tertiary age. The province extends from the Chinitna Valley southwestward across Cook Inlet to the tip of the Alaska Peninsula in southern Alaska.

Aleutian Arc - A prominent geographical feature that includes the Aleutian Island chain and extends into the Alaskan mainland. It is expressed topographically by volcanic peaks and ranges. The arc is a

product of subduction of the Pacific Plate under the North American Plate.

Anticline - An upfold or arch of stratified rock in which the beds or layers bend downward in opposite directions from the crest or axis of the fold.

Application for Permit to Drill (APD) - A document submitted by lease operators for review and approval by the USGS. This application, submitted in conjunction with Exploration Plans and prior to Development and Production Plans, includes an operational plan for a detailed casing, mud, and cementing program for a specific drilling operation.

Arch - An anticline.

Basement rock - Rock in the earth's crust beneath all sedimentary rocks.

Basin - A depression of the earth in which sedimentary materials accumulate or have accumulated, usually characterized by continuous deposition over a long period of time; a broad area of the earth beneath which the strata dip, usually from the sides toward the center.

Bedform - Any deviation from a flat bed generated by the flow on the bed of an alluvial channel.

Block - A geographical area, as portrayed on an official BLM protraction diagram or leasing map, that contains approximately 9 square miles (2,304 hectares or 5,693 acres).

Breakout - Sudden catastrophic local flooding caused by (1) fragmentation and breaking

away of a glacial ice-formed dam resulting in the rapid drainage of the glacier-fed lake behind it, or (2) a moraine rapidly draining the lake behind it. This flooding can rapidly transport large chunks of ice into the estuary and out to sea.

Cash bonus tract - A tract on which the winning bidder offers the highest price in addition to a fixed or sliding-scale royalty on production.

Clastic - Consisting of fragments of rocks or organic structures that have been moved individually from their places of origin.

Closure - In a fold, dome, or other structural trap, the vertical distance between the structure's highest point and its lowest contour that encloses itself. It is used in the estimation of petroleum resources and reserves.

Conglomerate - (1) rounded waterworn fragments of rock or pebbles, cemented together by another mineral substance; or (2) a cemented clastic rock containing rounded fragments corresponding in their grade sizes to gravel or pebbles.

Continental Margin - A zone separating the emergent continents from the deep sea bottom.

Continental Shelf - A broad, gently sloping, shallow feature extending from the shore to the Continental Slope.

Continental Slope - A relatively steep, narrow feature paralleling the Continental Shelf; the region in which the steepest descent to the ocean bottom occurs.

Continental Offshore Stratigraphic Test (COST) well - A well drilled to gather information about the stratigraphic formation present, the general character of the rocks, their porosity, and their permeability.

Development - Activities that take place following discovery of minerals in commer-

cially attractive quantities, including but not limited to geophysical activity, drilling, platform construction, and operation of all directly related onshore support facilities; and that are for the purpose of ultimately producing the minerals discovered.

Development and Production Plan - A plan describing the specific work to be performed, including all development and production activities that the lessee(s) propose(s) to undertake during the time period covered by the plan and all actions to be undertaken up to and including the commencement of sustained production. The plan also includes descriptions of facilities and operations to be used; well locations; current geological and geophysical information; environmental safeguards; safety standards and features; time schedules; and other relevant information. Under 30 CFR 250.34-2, all lease operators are required to formulate and obtain approval of such plans by the Director of the U.S. Geological Survey before development and production activities may commence.

Diapir - A piercing fold; an anticlinal fold in which a mobile core, such as salt, has broken through the more brittle overlying rocks.

Discovery - A find of significant quantities of hydrocarbons on a given lease.

Dome - A roughly symmetrical upfold, the beds dipping in all directions, more or less equally, from a point; any structural deformation characterized by local uplift approximately circular in outline, e.g., the salt domes of Louisiana and Texas.

Economically recoverable resource estimate - An assessment of the hydrocarbon potential that takes into account (1) physical and technological constraints on production and (2) the influence of costs of exploration and development and market price on industry investment in OCS exploration and production.

Environmental impact statement (EIS) - A document required by the National Environmental Policy Act of 1969 (NEPA) or similar State law in relation to any action significantly affecting the environment.

Epicenter - The point on the earth's surface directly above the focus of an earthquake.

Exploration - The process of searching for minerals. Exploration activities include (1) geophysical surveys where magnetic, gravity, seismic, or other systems are used to detect or infer the geologic conditions conducive to the accumulation of such minerals and (2) any drilling, whether on or off known geological structures. Exploration also includes the drilling of a well in which a discovery of oil or natural gas in paying quantities is made and the drilling of any additional well(s) after such a discovery that is needed to delineate a reservoir and to enable the lessee to determine whether to proceed with development and production.

Exploration Plan - A plan based on all available relevant information about a leased area that identifies, to the maximum extent possible, all the potential hydrocarbon accumulations and wells that the lessee(s) propose(s) to drill to evaluate the accumulations within the entire area of the lease(s) covered by the plan. Under 30 CFR 250.34-1, all lease operators are required to formulate and obtain approval of such plans by the Director of the U.S. Geological Survey before exploration activities may commence.

Fault - A fracture in the earth's crust accompanied by a displacement of one side of the fracture with respect to the other.

Field - An area underlain by one or more geologically related hydrocarbon reservoirs.

Formation - The primary unit in lithostrati-

graphy, consisting of a succession of strata useful for mapping or description.

Geologic constraint - A feature or condition posing difficulties for OCS operations that can be mitigated by design and engineering technology.

Geologic hazard - A feature or condition that, if undetected, may seriously jeopardize offshore oil and gas exploration and development activities and, once identified, may necessitate special engineering procedures or relocation of a well.

Geologic trap - An arrangement of rock strata, involving their structural relations or varied lithology and texture, that favors the accumulation of oil and gas.

Growth curve - A graphic representation of the relative growth of a population during a sequence of similar-length periods.

Hydrocarbon - Any of a large class of organic compounds containing only carbon and hydrogen, comprising paraffins, olefins, members of the acetylene series, alicyclic hydrocarbons, and aromatic hydrocarbons, and occurring in many cases in petroleum, natural gas, coal, and bitumens.

Lease - A contract authorizing exploration for and development and production of minerals; the land covered by such a contract.

Lease sale - The public opening of sealed bids made after competitive auction for leases granting companies or individuals the right to explore for and develop certain minerals within a defined period of time.

Line mile - The linear distance of one mile by which geophysical surveys are measured. Such surveys are usually conducted in a grid pattern, and the total mileage covered in crossing and recrossing the grid is expressed in terms of line miles.

Magnitude - A rough measure of earthquake

size based on the ground motion recorded by a seismograph. Richter magnitude (M_L) is calculated by taking the common logarithm of the largest motion (revealed by a deflection on the seismograph) recorded during the arrival of a seismic wave.

Mass movement - Unit movement of a portion of the land surface, as in creep, landslide, or slip. Mass movement, or slumping, can occur where unconsolidated sediments are distributed over a steep gradient.

Moraine - An accumulation of earth and stones carried and finally deposited by a glacier.

National Marine Fisheries Service - A branch of the National Oceanic and Atmospheric Administration whose purpose is to research the development and maintenance of fish resources.

Nautical mile - A unit equal to 6,080.2 ft or 1,853.2 m.

On/off shift - A work pattern in which an employee works several weeks continuously, then has the same amount of time off.

Organic matter - Material derived from living organisms.

Outer Continental Shelf (OCS) - All submerged lands that comprise the Continental Margin adjacent to the U.S. The OCS remains subject to Federal jurisdiction and control after enactment of the Submerged Lands Act (43 USC 1301 and 1302).

Pacific-Margin Tertiary Province - An onshore and offshore area in southeastern Alaska of approximately 103,594 square km (40,000 square mi) that is underlain by a thick sequence of continental and marine strata ranging in age from Paleocene through Pliocene.

Permeability - The capacity to be penetrated or diffused through; the ability to transmit fluids.

Permeable - Capable of being penetrated or diffused through.

Petroleum - An oily, flammable bituminous liquid that occurs in many places in the upper strata of the earth, either in seepages or in reservoir formations; essentially a complex mixture of hydrocarbons of different types with small amounts of other substances; any of various substances (as natural gas or shale oil) similar in composition to petroleum.

Petroliferous - Containing or yielding petroleum.

Platform - A steel or concrete structure from which offshore wells are drilled.

Porosity - The capability to contain fluids within void spaces; the percent of open space in a rock.

Porous - Capable of containing fluids within void spaces.

Production curve - A curve plotted to show the relation between quantities produced during definite consecutive time intervals.

Proprietary information - Geologic and geophysical data and immediate derivatives thereof that cannot be released to the general public because of Federal law, regulations, or statutes, or because of contractual requirements.

Province - An area throughout which geological history has been essentially the same or that is characterized by particular structural, petrographic, or physiographic features.

Recoverable resource estimate - An assessment of oil and gas resources that takes into account the fact that physical and technological constraints dictate that only a portion of resources or reserves can be brought to the surface.

Refining - Fractional distillation, usually followed by other processing (as cracking).

Reserve estimate - An assessment of the portion of the identified oil or gas resource that can be economically extracted.

- Reserves** - Portion of the identified oil or gas resource that can be economically extracted.
- Reservoir** - An accumulation of hydrocarbons that is separated from any other such accumulation.
- Resource** - Concentration of naturally occurring solid, liquid, or gaseous materials in or on the earth's crust.
- Rig** - Apparatus used for drilling an oil or gas well.
- Risked resource estimate** - An assessment of oil or gas resources that has been modified to take into account the estimator's confidence in the estimate (i.e., "risked" to account for the probability that economically recoverable resources will actually be found within the area of interest).
- Risked, economically recoverable resource estimate** - An assessment of oil or gas resources that has been modified to take into account (1) physical and technological constraints on production; (2) the influence of the costs of exploration and development and market price on industry investment in OCS exploration and production; and (3) the estimator's confidence in the estimate.
- Royalty tract** - A leased tract for which the bidder offers a minimal cash payment but instead proposes to pay the Federal government a significant royalty on any oil and/or gas profits.
- Sandstone** - A sedimentary rock made up of sand that usually consists of quartz more or less firmly united by some cement (as silica, iron oxide, or calcium carbonate).
- Sediment** - Material or a mass of material deposited (as by water, wind, or glaciers).
- Sedimentary rocks** - Rock formed of mechanical, chemical, or organic sediment.
- Seepage** - Oozing of petroleum from the earth.
- Seismic** - Pertaining to, characteristic of, or produced by earthquakes or earth vibration; having to do with elastic waves in the earth.
- Seismic reflection survey** - A program for mapping geologic structures by creating seismic waves and observing their arrival times as they are reflected from discontinuities. The energy source for creating the waves is usually delivered to the earth for very short periods of time.
- Shale** - A fissile rock that is formed by the consolidation of clay, mud, or silt, has a finely stratified or laminated structure parallel to the bedding, and is composed of minerals that have been essentially unaltered since deposition.
- Siliceous** - Of, pertaining to, or containing silica or quartz.
- Siltstone** - A very fine-grained, consolidated clastic rock largely composed of particles of silt grade.
- Slumping** - (See mass movement).
- Source bed** - Rocks containing large amounts of organic matter that is transformed into hydrocarbons.
- Spit** - A small point of land commonly consisting of sand or gravel deposited by waves and currents and running into a body of water.
- Spud** - To begin drilling a well.
- Stratum (pl., strata)** - A tabular mass or thin sheet of sedimentary rock or earth of one kind formed by natural causes and made up usually of a series of layers lying between beds of other kinds.
- Stratigraphic trap** - A reservoir, capable of holding oil or gas, that is formed from a change in the character of the reservoir rock. Such a trap is harder to locate than a structural trap because it is not readily revealed by geological or geophysical surveys.
- Structural trap** - A reservoir, capable of holding oil or gas, that is formed from crustal movements in the earth that fold

or fracture rock strata in such a manner that oil or gas accumulating in the strata are sealed off and cannot escape. In some cases "structure" may be synonymous with structural trap.

Subsidence - A sinking of a large part of the earth's crust; movement in which there is no free side and surface material is displaced vertically downward with little or no horizontal component.

Subsurface geology - The study of structure, thickness, facies, correlation, etc. of rock formations beneath land or sea-floor surfaces by means of drilling for oil or water, core drilling, and geophysical prospecting.

Summary Report - Document prepared by the Department of the Interior pursuant to 30 CFR 252.4 that is intended to inform affected State and local governments as to current OCS reserve estimates, projections of magnitude and timing of development, transportation planning, and general location and nature of nearshore and onshore facilities.

Supply boat - Vessel that ferries food, water, fuel, and drilling supplies and equipment to a rig and returns to land with refuse that cannot be disposed of at sea.

Tract - The geographic and legal extent of a single lease area; a convenient way of numbering blocks offered for sale so that they can be sequentially numbered in the process of offering.

Trap - A geologic feature that forms a reservoir enclosing and preventing the escape of accumulated fluids (hydrocarbons or water).

Truncated - Terminated abruptly as if cut or broken off.

Tsunami - A great wave generated by submarine crustal displacement or landslides; associated with major earthquakes and volcanic eruptions. Also called a "seismic sea wave."

Undiscovered resources - Quantities of oil and gas estimated to exist outside known fields.

Uplift - Elevation of any extensive part of the earth's surface relative to other parts.

Wildcat strike - A discovery of oil or gas in an unproved area.

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